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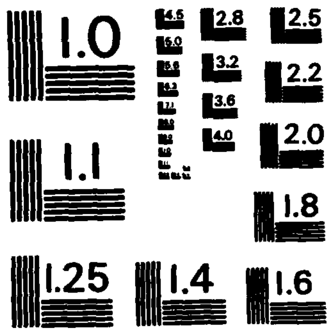
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HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM
OPTOMA16
20 May - 23 JUNE 1985

by

Paul A. Wittmann
Edward A. Kelley, Jr.
Christopher N.K. Mooers

August 1985

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This report was Prepared by:

Paul A. Wittmann

PAUL A. WITTMANN
Oceanographer

EDWARD A. KELLEY, JR.
Adjunct Prof., Oceanography

CHRISTOPHER N.K. MOOERS
Professor and Chairman,
Department of Oceanogrpahy

Reviewed by:

Christopher N.K. Mooers, Chairman
Department of Oceanography

Released by:

John N. Dyer
Dean of Science and Engineering

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The three cruises, Legs MI, MII and A, were undertaken in May and June 1985. This report presents the hydrographic data, acquired by XBT and CTD casts, from the cruises.

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Hydrographic Data from the **OPTOMA** *Program:*

OPTOMA16

20 May - 23 June, 1985

by

Paul A. Wittmann
Edward A. Kelley, Jr.
Christopher N. K. Mooers

Chief Scientists:

A. A. Bird, E. A. Kelley, Jr.
C. N. K. Mooers

The **OPTOMA** Program is a joint program of

Department of Oceanography
Naval Postgraduate School
Monterey, CA 93943.

Center for Earth and Planetary Physics
Harvard University
Cambridge, MA 02138.

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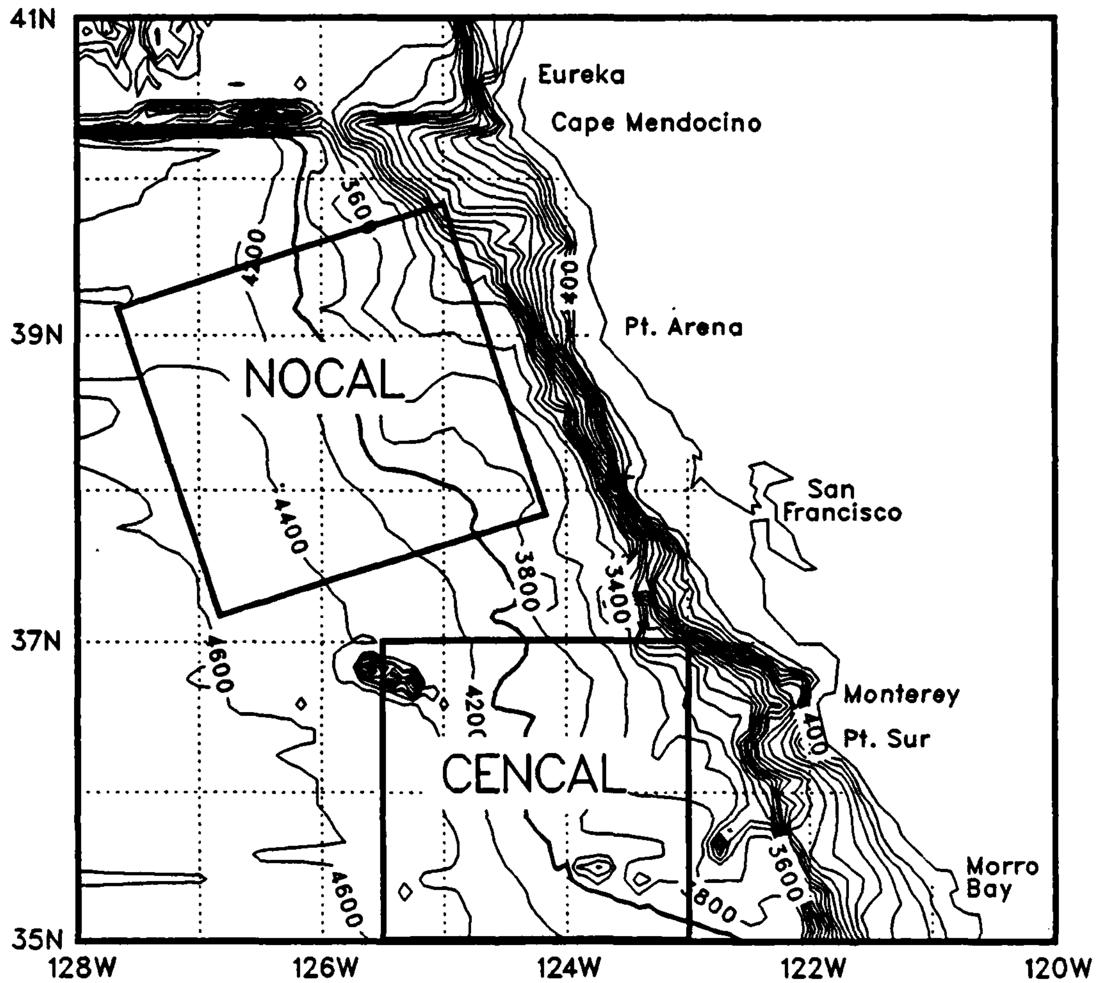


Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observations, Modeling and Analysis) Program~~, a joint~~ NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

Two cruises were undertaken, during May and June 1985, in the NOAA Ship MCARTHUR and one cruise in the R/V ACANIA during June 1985. Hydrographic data were acquired off the coast of Washington, Oregon, and California in an area which covered and extended the NOCAL regions.

Leg MI was carried out from 20 May to 1 June and sampled an area approximately 370km by 450km centered about 280km off the coast between Pt. Arena and Cape Mendocino, with additional transects from San Francisco and to Eureka, as shown in Figure 2.

Leg MII was carried out from 4 to 11 June, and sampled an area approximately 200km by 330km centered about 200km off the coast from Cape Mendocino, with additional transects from Eureka and to the straits of Juan de Fuca, as shown in Figure 13.

Leg A was carried out from 13 to 23 June, and sampled the shelf and slope waters from nearshore to about 50km offshore from Pt. Reyes to Eureka, with additional transects from and to Monterey as shown in Figure 24.

On each cruise track, transect extremes are identified by letter in these figures to aid in cross-referencing the data presented in subsequent figures. On each of these cruises, hydrographic stations were occupied at approximately 18km along the track.

DATA ACQUISITION

Data acquired during Leg MI, Leg MII and Leg A include XBT and CTD profiles. Bucket surface temperature and water samples for salinity were taken at most CTD stations. These surface values were used for calibration purposes as well as contributions to the data base. Leg A also acquired continuous 2m thermosalinograph measurements, continuous meteorological data such as atmospheric pressure at a height of 2m and wind speed and direction at a height of 20m, and acoustic Doppler velocity data.

The XBT data on Legs MI and MII were acquired using a SEAS system (Bathy Systems, Inc.) that had been installed recently on the NOAA Ship MCARTHUR; data were recorded using an HP 85 computer, on cassettes. The XBT data on Leg A were digitized using a Sippican MK9 unit; data were recorded, using an HP200 series computer, on data disks. The continuous "underway" data were digitized using an HP 5328 frequency counter and a 40 channel digital voltmeter. The continuous data were averaged over two-minute intervals. All data were transferred to the IBM 3033 mainframe computer for editing and processing.

Station positions aboard ship were determined by Loran C fixes and are claimed to be accurate to within about 0.1 km. Neil Brown CTD's and Sippican XBT's were used during Legs MI, MII and Leg A. Their accuracies are stated in Table 1. The bottle surface salinity samples from Leg MI and Leg MII were determined onboard by a Plessy salinometer; its accuracy is contained in Table 1. Samples from Leg A were determined ashore by a Guildline Model 8400 "Autosal" salinometer with an accuracy of ± 0.003 ppt.

DATA PROCESSING

Data processing, such as estimating depth profiles for the XBT temperature profiles based on the descent speed, and conversion of CTD conductivity to salinity using the algorithm given in Lewis and Perkin (1981), was carried out on

the IBM 3033 at the Naval Postgraduate School. The data were then edited by removing obvious salinity spikes and eliminating cast failures that were not identified during the cruise. Approximately 100%, 100%, and 98% of casts were retained in the data sets of Legs MI, MII, and A, respectively. From a comparison of the CTD salinities with the salinity samples from the bottles, it was determined that the salinity offsets were .007, .001, and .01 ppt for Legs MI, MII, and A, respectively. No corrections were made to the salinities. The CTD data were interpolated to 5 m intervals and then up and down casts were averaged.

The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, DC.

DATA PRESENTATION

The cruise track, station locations (with XBT's and CTD's identified) and station numbers are shown in the first three figures of each of the next three sections, which present the data from Legs MI, MII and A, respectively. These figures are followed by a listing of the stations, with their coordinates, the date and time at which the station was occupied, and the surface information obtained at the station.

Vertical profiles of temperature from the XBT casts are shown in staggered fashion. The location of these profiles may be found by reference to the various maps of the cruise tracks. Transect extremes are identified as nearly as possible. The first profile on each plot is shown with its temperature unchanged; to each subsequent profile an appropriate multiple of 5C has been added. Vertical profiles from the CTD's follow. Profiles of temperature are staggered by 5C and those of salinity by 4 ppt.

Isotherms for each transect are shown in the next pages, followed by isopleths of temperature, salinity and sigma-t, from the CTD's, when four or

more casts were acquired along a transect. Based on instrument accuracy and the vertical temperature gradient, it is estimated that depths of isotherms in the main thermocline are uncertain to ±20m. The tick marks identify station positions and, again, the transect extremes are shown on these plots.

Sections 1, 2, and 3 include mean profiles of temperature from the XBT's and CTD's. In addition mean profiles of temperature, salinity and sigma-t from the CTD's are given, as well as a scatter diagram of the T-S pairs and the mean S(T) curve, with the ± standard deviation envelope; the data presentation concludes with a plot of the mean N^2 (Brunt-Vaisala frequency squared) profile, with ± the standard deviation. On the sigma-t and N^2 plots, the appropriate profiles derived from the mean temperature and mean salinity profiles are also shown.

Table 1: Scientific instruments aboard the NOAA Ship McARTHUR

Instrument	Variable	Sensor	Accuracy	Resolution
Neil Brown CTD Mark IIIb	pressure	strain gage	1.6 db	0.025 db
	temperature	thermistor	0.005 C	0.0005 C
	conductivity	electrode cell	0.005 mmho	0.001 mmho
Sippican BT	temperature	thermistor	0.2 C	
	depth	descent speed	greater of 4.6 m and 2% of depth	
Plessey CTD	pressure		±0.04% of depth	
	temperature		±0.005 C	
	conductivity		±0.005 mmho	
Plessey salinometer	salinity		±0.003ppt	

Table 2: Scientific instruments aboard the R/V ACANIA

Instrument	Variable	Sensor	Accuracy	Resolution
Neil Brown CTD Mark IIIb	pressure temperature conductivity	strain gage thermistor electrode cell	1.6 db 0.005 C 0.005 mmho	0.025 db 0.0005 C 0.001 mmho
Sippican BT	temperature depth	thermistor descent speed	0.2 C greater of 4.6 m and 2% of depth	
* Guildline Autosal	conductivity	electrode cell	0.003 ppt	0.0002 ppt
Amatek straza ADVP	velocity profiles to 100m	4 beam sonar	3 cm/sec relative to ship speed	3 cm/sec
Rosemount Sensor	sea surface temperature	platinum thermometer	0.05 C	0.005 C
Sea-Bird Sensors	temperature conductivity at 2 meters	thermistor electrode cell	0.003 C 0.003 mmho	0.0005 C 0.0005 mmho
Rosemount Sensor	air temperature	thermometer	0.01 C	
Kavolico Barometer	atmospheric pressure	pressure transducer	1.5 mb	0.1 mb
* 1200 EPS Hygrometer	dew point	condensation temp. sensor	0.2 C	0.02 C
Meteorology Res. Inc.	wind speed	anemometer	0.15 mph or 1%	
Meteorology Res. Inc.	wind direction	vane	2.5 degrees	
Internav LC408 LORAN C	position	two chain LORAN receiver	100 meters	10 meters
Motorola Miniranger	position	microwave transponders	4 meters	2 meters

* Not operating on the OPTOMA16 cruise.

SECTION 1

OPTOMA16 LEG MI

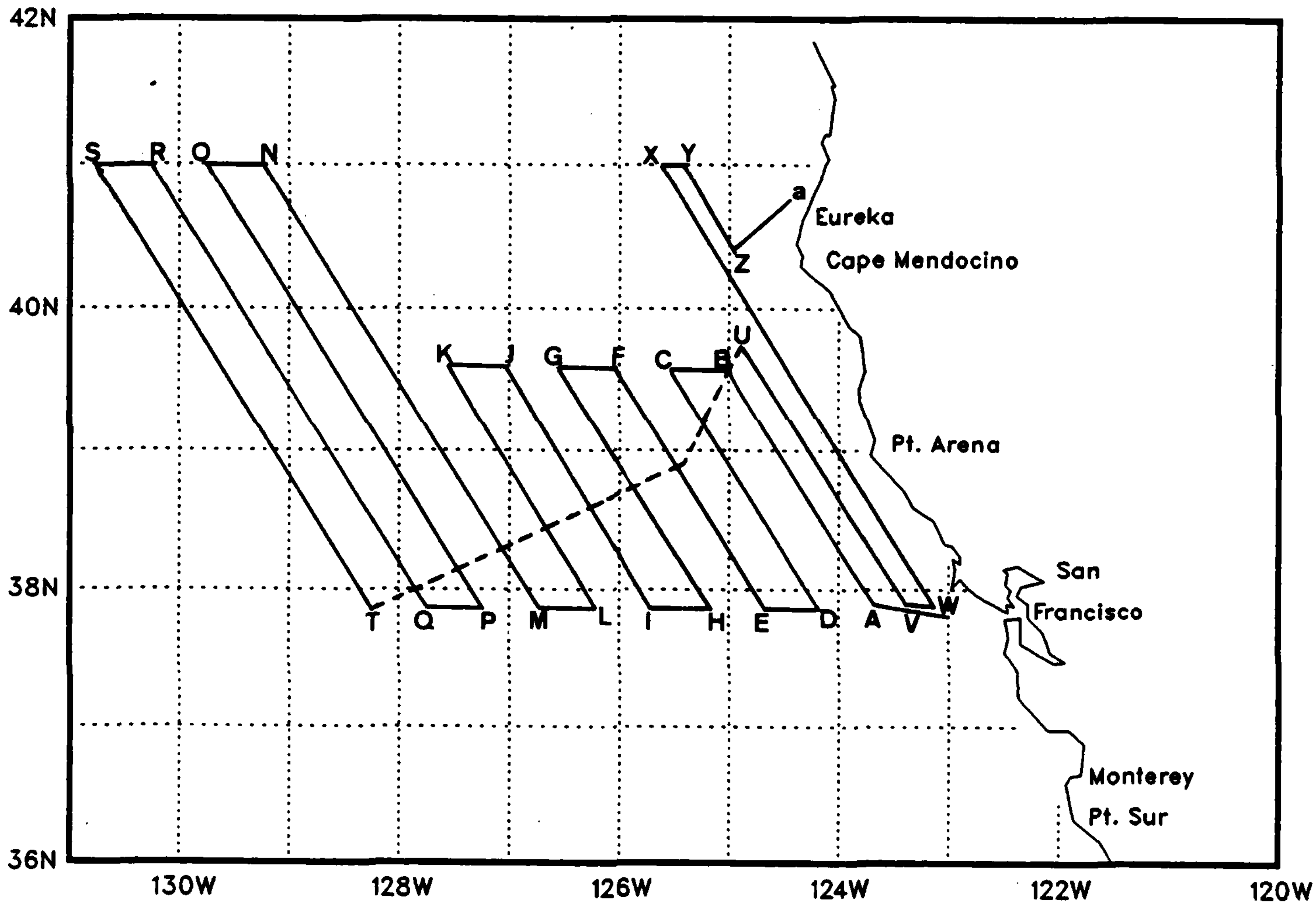


Figure 2: The cruise track for OPTOMA16, Leg MI.

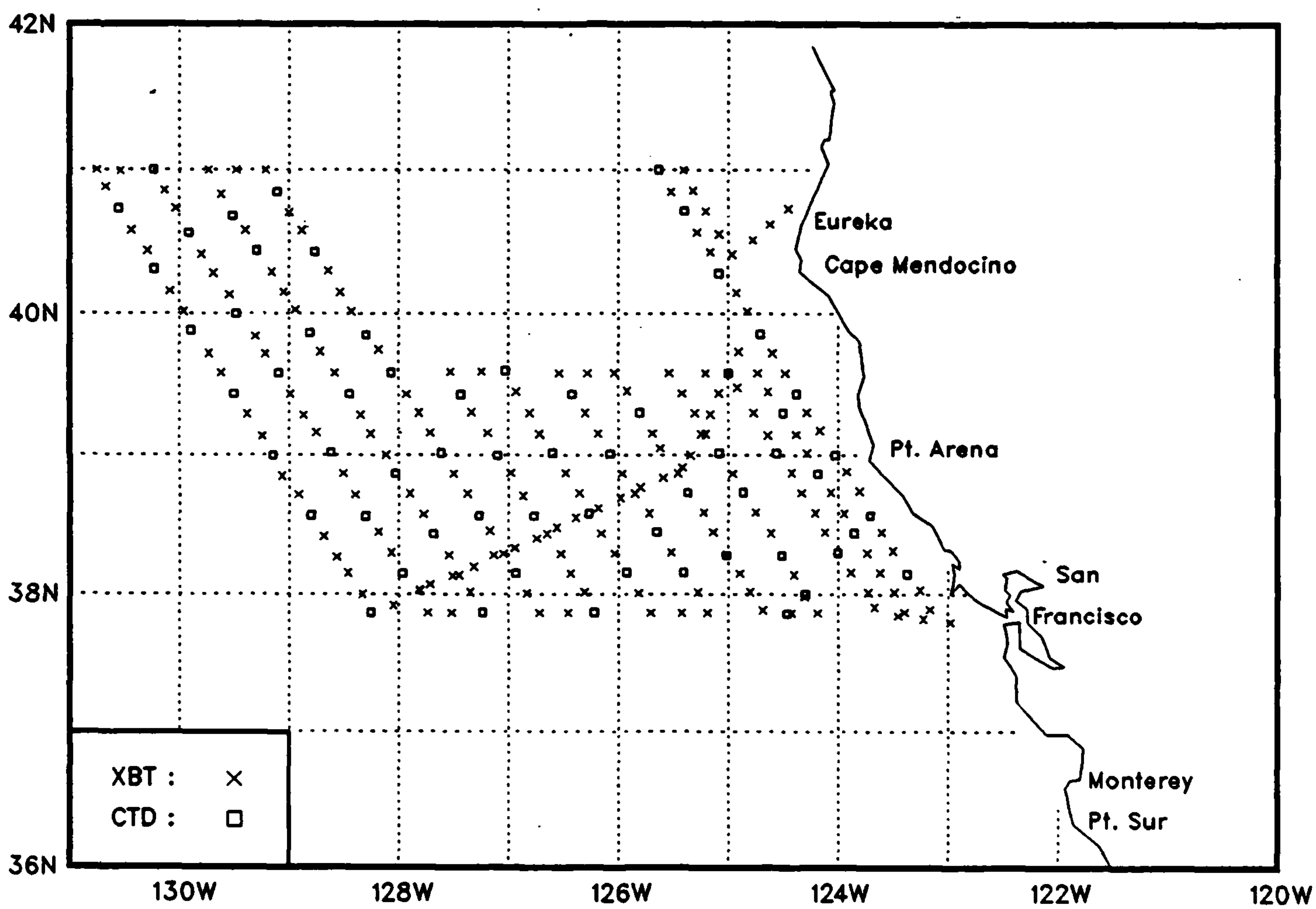


Figure 3: XBT and CTD locations for OPTOMA16, Leg MI.

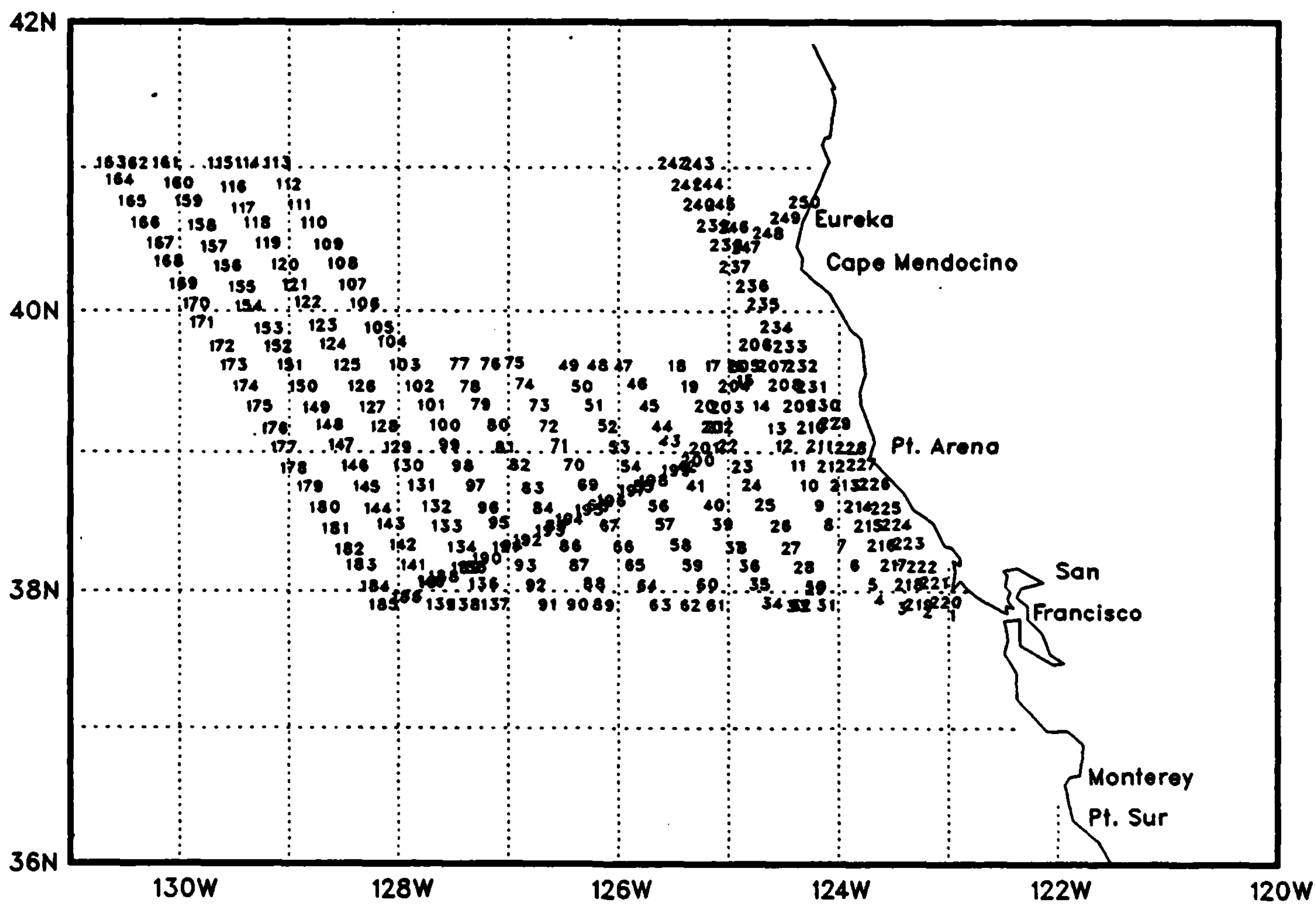


Figure 4: Station numbers for OPTOMA16, Leg MI.

Table 3 : Leg MI Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	85140	2240	37.48	122.58	10.9			
2	XBT	85140	2352	37.49	123.13	10.2			
3	XBT	85141	111	37.51	123.27	9.9			
4	XBT	85141	218	37.54	123.40	10.5			
5	XBT	85141	258	38.01	123.43	10.9			
6	XBT	85141	349	38.09	123.53	10.6			
7	CTD	85141	456	38.18	124.00	10.8	33.48	11.1	33.47
8	XBT	85141	607	38.27	124.07	10.7			
9	XBT	85141	701	38.35	124.12	10.8			
10	XBT	85141	758	38.44	124.20	11.4			
11	XBT	85141	854	38.52	124.25	12.1			
12	CTD	85141	1014	39.01	124.34	12.3	32.90	12.7	32.86
13	XBT	85141	1140	39.08	124.38	12.3			
14	XBT	85141	1234	39.18	124.46	11.7			
15	XBT	85141	1344	39.29	124.55	11.4			
16	XBT	85141	1421	39.35	125.00	11.5			
17	XBT	85141	1520	39.35	125.12	12.2			
18	XBT	85141	1634	39.35	125.32	11.6			
19	XBT	85141	1725	39.26	125.25	12.2			
20	XBT	85141	1812	39.18	125.18	12.3			
21	XBT	85141	1859	39.09	125.12	12.5			
22	CTD	85141	2008	39.01	125.05	12.8	32.87	13.0	32.88
23	XBT	85141	2133	38.52	124.57	12.5			
24	CTD	85141	2244	38.44	124.52	12.9	32.88	13.3	32.87
25	XBT	85142	8	38.35	124.45	12.7			
26	XBT	85142	57	38.26	124.36	12.7			
27	CTD	85142	256	38.17	124.31	12.7	32.60	12.9	32.58
28	XBT	85142	432	38.09	124.24	12.1			
29	XBT	85142	600	37.59	124.18	11.6			
30	CTD	85142	638	38.00	124.18	11.9	32.75	11.9	32.71
31	XBT	85142	813	37.52	124.11	12.0			
32	XBT	85142	911	37.52	124.25	12.3			
33	CTD	85142	939	37.52	124.28	12.5	32.69	*	*
34	XBT	85142	1127	37.53	124.41	11.6			
35	XBT	85142	1221	38.01	124.48	12.4			
36	XBT	85142	1329	38.09	124.54	12.3			
37	XBT	85142	1605	38.17	125.01	12.6			
38	CTD	85142	1630	38.17	125.01	12.9	32.87	13.1	32.88
39	XBT	85142	1746	38.27	125.08	13.0			
40	XBT	85142	1835	38.35	125.13	13.0			
41	CTD	85142	1946	38.44	125.22	13.3	32.87	13.6	32.87
42	XBT	85142	2055	38.52	125.27	12.9			
43	XBT	85142	2206	39.03	125.37	13.0			
44	XBT	85142	2234	39.09	125.41	13.1			
45	CTD	85142	2338	39.18	125.48	13.4	32.88	13.9	32.87

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
46	XBT	85143	55	39.27	125.55	13.2			
47	XBT	85143	145	39.35	126.02	12.9			
48	XBT	85143	247	39.35	126.16	13.1			
49	XBT	85143	347	39.35	126.32	13.6			
50	CTD	85142	502	39.26	126.25	13.3	32.36	13.3	32.63
51	XBT	85143	613	39.18	126.18	13.9			
52	XBT	85143	701	39.09	126.11	13.2			
53	CTD	85143	822	39.01	126.04	13.5	32.88	13.8	32.86
54	XBT	85143	927	38.52	125.58	13.3			
55	XBT	85143	1018	38.43	125.51	13.3			
56	XBT	85143	1107	38.35	125.43	13.1			
57	CTD	85143	1218	38.27	125.39	13.5	32.84	13.6	32.84
58	XBT	85143	1334	38.18	125.31	13.5			
59	CTD	85143	1450	38.09	125.24	13.0	32.64	13.3	32.63
60	XBT	85143	1613	38.01	125.16	13.5			
61	XBT	85143	1704	37.52	125.11	13.0			
62	XBT	85143	1813	37.52	125.25	13.4			
63	XBT	85143	1913	37.52	125.42	13.8			
64	XBT	85143	2005	38.00	125.49	14.1			
65	CTD	85143	2116	38.09	125.56	13.9	32.71	13.7	32.93
66	XBT	85143	2226	38.17	126.02	14.3			
67	XBT	84144	4	38.26	126.09	13.4			
68	CTD	85144	10	38.35	126.16	14.3	32.80	14.7	32.78
69	XBT	85144	138	38.44	126.21	13.7			
70	XBT	85144	227	38.52	126.29	14.2			
71	CTD	85144	332	39.01	126.36	14.3	32.57	14.7	32.87
72	XBT	85144	440	39.09	126.43	14.2			
73	XBT	85144	529	39.18	126.48	13.4			
74	XBT	85144	617	39.27	126.56	13.9			
75	CTD	85144	734	39.36	127.01	13.6	32.64	13.9	32.62
76	XBT	85144	836	39.35	127.14	13.7			
77	XBT	85144	939	39.35	127.31	13.8			
78	CTD	85144	1050	39.26	127.26	13.9	32.79	14.1	32.78
79	XBT	85144	1149	39.18	127.20	13.7			
80	XBT	85144	1237	39.09	127.11	13.6			
81	CTD	85144	1344	39.00	127.06	13.3	32.71	13.6	32.70
82	XBT	85144	1452	38.52	126.59	13.3			
83	XBT	85144	1540	38.42	126.52	12.8			
84	CTD	85144	1644	38.34	126.46	13.8	32.49	13.8	32.76
85	XBT	85144	1751	38.26	126.39	13.5			
86	XBT	85144	1843	38.17	126.31	13.4			
87	XBT	85144	1933	38.09	126.26	13.8			
88	XBT	85144	2021	38.01	126.18	13.9			
89	CTD	85144	2138	37.52	126.13	14.0	32.82	14.1	32.85
90	XBT	85144	2251	37.52	126.27	14.0			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
91	XBT	85144	2350	37.52	126.43	13.7			
92	XBT	85145	44	38.00	126.50	13.6			
93	CTD	85145	147	38.09	126.56	13.7	32.66	13.9	32.65
94	XBT	84145	249	38.18	127.03	13.3			
95	XBT	84145	342	38.27	127.10	13.2			
96	CTD	85145	506	38.34	127.16	13.8	32.70	14.0	32.89
97	XBT	84145	635	38.43	127.22	13.5			
98	XBT	85145	728	38.52	127.30	13.3			
99	CTD	85145	835	39.01	127.37	13.1	32.65	13.3	32.64
100	XBT	85145	939	39.09	127.42	13.4			
101	XBT	85145	1039	39.18	127.49	13.3			
102	XBT	85145	1145	39.26	127.56	13.0			
103	CTD	85145	1307	39.35	128.04	13.0	32.61	13.1	32.60
104	XBT	85145	1428	39.45	128.11	13.3			
105	CTD	85145	1553	39.51	128.18	13.4	32.65	12.8	32.75
106	XBT	85145	1726	40.01	128.26	12.8			
107	XBT	85145	1838	40.09	128.32	13.2			
108	XBT	85145	1953	40.18	128.38	12.5			
109	CTD	85145	2117	40.26	128.46	13.2	32.77	13.3	32.76
110	XBT	85145	2228	40.35	128.53	12.8			
111	XBT	85145	2328	40.42	129.00	12.9			
112	CTD	85146	50	40.51	129.07	13.0	32.71	13.2	32.71
113	XBT	85146	214	41.00	129.13	12.8			
114	XBT	85146	316	41.00	129.29	12.8			
115	XBT	85146	419	41.00	129.44	12.7			
116	XBT	85146	518	40.50	129.37	13.2			
117	CTD	85146	621	40.41	129.31	12.9	32.72	13.1	32.71
118	XBT	85146	727	40.35	129.24	12.8			
119	CTD	85146	832	40.26	129.18	13.0	32.78	13.2	32.77
120	XBT	85146	941	40.17	129.09	13.2			
121	XBT	85146	1029	40.09	129.03	12.9			
122	XBT	85146	1115	40.02	128.56	13.1			
123	CTD	85146	1219	39.52	128.49	13.3	32.86	13.5	32.87
124	XBT	85146	1322	39.44	128.43	13.1			
125	XBT	85146	1412	39.35	128.35	13.0			
126	CTD	85146	1527	39.26	128.27	13.0	32.76	13.1	32.74
127	XBT	85146	1636	39.17	128.21	12.5			
128	XBT	85146	1725	39.09	128.15	12.7			
129	XBT	85146	1814	39.00	128.07	13.0			
130	CTD	85146	1927	38.52	128.02	12.9	32.73	13.1	32.72
131	XBT	85146	2030	38.43	127.54	12.7			
132	XBT	85146	2118	38.34	127.46	13.1			
133	CTD	85146	2219	38.26	127.41	13.4	32.92	13.5	32.90
134	XBT	85146	2320	38.17	127.32	13.4			
135	XBT	85147	10	38.08	127.27	13.4			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
136	XBT	85147	102	38.01	127.21	13.3			
137	CTD	85147	213	37.52	127.14	13.4	32.77	13.4	32.77
138	XBT	85147	351	37.52	127.31	13.5			
139	XBT	85147	447	37.52	127.44	13.5			
140	XBT	85147	555	38.02	127.49	13.4			
141	CTD	85147	718	38.09	127.58	13.0	32.87	13.1	32.86
142	XBT	85147	830	38.18	128.04	12.9			
143	XBT	85147	936	38.27	128.11	13.0			
144	CTD	85147	1059	38.34	128.18	13.2	32.72	13.3	32.71
145	XBT	85147	1228	38.43	128.24	13.3			
146	XBT	85147	1333	38.52	128.30	13.3			
147	CTD	85147	1453	39.01	128.37	13.4	32.84	13.6	32.84
148	XBT	85147	1616	39.10	128.45	13.4			
149	XBT	85147	1719	39.17	128.52	13.1			
150	XBT	85147	1822	39.26	129.00	13.5			
151	CTD	85147	1947	39.35	129.06	13.6	32.96	13.8	32.96
152	XBT	85147	2058	39.43	129.13	13.6			
153	XBT	85147	2150	39.50	129.18	13.7			
154	CTD	85147	2255	40.00	129.29	13.9	33.00	14.2	32.98
155	XBT	85147	2356	40.08	129.32	13.9			
156	XBT	85148	46	40.17	129.41	13.6			
157	XBT	85148	136	40.25	129.48	13.2			
158	CTD	85148	243	40.34	129.55	13.3	32.93	13.4	32.92
159	XBT	85148	351	40.44	130.02	13.0			
160	XBT	85148	442	40.52	130.08	12.6			
161	CTD	85148	552	41.00	130.14	12.7	32.78	12.8	32.72
162	XBT	85148	715	41.00	130.32	12.4			
163	XBT	85148	800	41.00	130.45	12.6			
164	XBT	85148	840	40.53	130.40	12.4			
165	CTD	85148	950	40.44	130.33	12.8	32.81	13.7	32.80
166	XBT	85148	1042	40.35	130.26	12.8			
167	XBT	85148	1133	40.26	130.17	13.1			
168	CTD	85148	1231	40.19	130.13	13.6	32.99	13.8	32.96
169	XBT	85148	1336	40.09	130.05	13.7			
170	XBT	85148	1425	40.01	129.57	13.7			
171	CTD	85148	1534	39.53	129.54	14.0	32.99	14.2	32.99
172	XBT	85148	1648	39.43	129.43	13.9			
173	XBT	85148	1737	39.35	129.37	14.0			
174	CTD	85148	1849	39.26	129.30	14.0	32.99	14.2	32.99
175	XBT	85148	1953	39.17	129.23	13.9			
176	XBT	85148	2047	39.08	129.14	13.3			
177	CTD	85148	2158	39.00	129.09	13.3	32.80	13.4	32.79
178	XBT	85148	2312	38.51	129.04	13.2			
179	XBT	85149	0	38.43	128.55	13.7			
180	CTD	85149	100	38.34	128.48	14.0	32.93	14.2	32.93

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
181	XBT	85149	152	38.25	128.41	13.8			
182	XBT	85149	240	38.16	128.34	13.5			
183	XBT	85149	327	38.09	128.28	13.7			
184	XBT	85149	416	38.00	128.20	13.5			
185	CTD	85149	528	37.52	128.15	14.0	32.89	14.2	32.88
186	XBT	85149	630	37.55	128.03	13.2			
187	XBT	85149	744	38.02	127.48	13.4			
188	XBT	85149	809	38.04	127.43	13.7			
189	XBT	85149	856	38.08	127.30	13.4			
190	XBT	85149	945	38.12	127.19	13.0			
191	XBT	85149	1036	38.17	127.08	12.6			
192	XBT	85149	1126	38.20	126.56	12.7			
193	XBT	85149	1216	38.24	126.44	12.9			
194	XBT	85149	1307	38.29	126.33	12.8			
195	XBT	85149	1357	38.33	126.23	12.8			
196	XBT	85149	1447	38.37	126.11	12.8			
197	XBT	85149	1536	38.42	125.59	12.9			
198	XBT	85149	1625	38.46	125.48	12.8			
199	XBT	85149	1714	38.50	125.35	12.7			
200	XBT	85149	1801	38.55	125.25	13.2			
201	XBT	85149	1909	39.00	125.20	13.0			
202	XBT	85149	2001	39.09	125.14	12.9			
203	XBT	85149	2051	39.17	125.09	13.1			
204	XBT	85149	2141	39.26	125.05	13.1			
205	CTD	85149	2241	39.35	125.00	11.9	32.19	11.9	32.22
206	XBT	85149	2352	39.44	124.54	12.2			
207	XBT	85150	53	39.35	124.43	10.9			
208	XBT	85150	141	39.27	124.38	11.6			
209	CTD	85150	243	39.18	124.30	12.3	32.27	12.5	32.26
210	XBT	85150	343	39.09	124.23	11.8			
211	XBT	85150	430	39.01	124.17	11.4			
212	CTD	85150	531	38.52	124.11	11.3	32.97	11.4	32.97
213	XBT	85150	633	38.44	124.04	10.7			
214	XBT	85150	723	38.35	123.57	10.9			
215	CTD	85150	827	38.27	123.51	11.6	33.16	11.7	33.15
216	XBT	85150	936	38.18	123.44	10.8			
217	XBT	85150	1023	38.09	123.37	10.1			
218	XBT	85150	1110	38.01	123.29	10.3			
219	XBT	85150	1201	37.52	123.23	10.3			
220	XBT	85150	1259	37.53	123.09	9.9			
221	XBT	85150	1339	38.02	123.15	9.9			
222	CTD	85150	1438	38.09	123.22	9.4	33.80	9.6	33.80
223	XBT	85150	1533	38.19	123.30	9.6			
224	XBT	85150	1626	38.27	123.36	10.2			
225	CTD	85150	1727	38.34	123.42	11.4	33.26	11.6	33.27

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
226	XBT	85150	1826	38.45	123.48	11.1			
227	XBT	85150	1921	38.53	123.55	12.1			
228	CTD	85150	2013	39.00	124.01	11.9	32.95	12.2	32.95
229	XBT	85150	2107	39.10	124.10	12.4			
230	XBT	85150	2204	39.18	124.17	12.6			
231	CTD	85150	2303	39.26	124.23	11.4	32.52	12.0	32.44
232	XBT	85151	2	39.35	124.28	12.1			
233	XBT	85151	53	39.43	124.35	12.8			
234	CTD	85151	148	39.51	124.43	12.7	33.13	12.8	33.12
235	XBT	85151	255	40.01	124.49	11.5			
236	XBT	85151	337	40.09	124.55	12.0			
237	CTD	85151	440	40.17	125.05	11.5	32.42	11.7	32.46
238	XBT	85151	550	40.26	125.10	12.3			
239	XBT	85151	644	40.34	125.17	12.7			
240	CTD	85151	738	40.43	125.24	12.8	32.41	12.9	32.40
241	XBT	85151	847	40.51	125.31	12.9			
242	CTD	85151	940	41.00	125.38	12.8	32.41	13.0	32.40
243	XBT	85151	1044	41.00	125.24	12.7			
244	XBT	85151	1136	40.51	125.19	12.6			
245	XBT	85151	1221	40.43	125.12	12.4			
246	XBT	85151	1314	40.33	125.05	12.4			
247	XBT	85151	1411	40.25	124.58	11.1			
248	XBT	85151	1504	40.31	124.46	11.3			
249	XBT	85151	1556	40.38	124.37	12.0			
250	XBT	85151	1646	40.44	124.27	12.3			

* Data not available

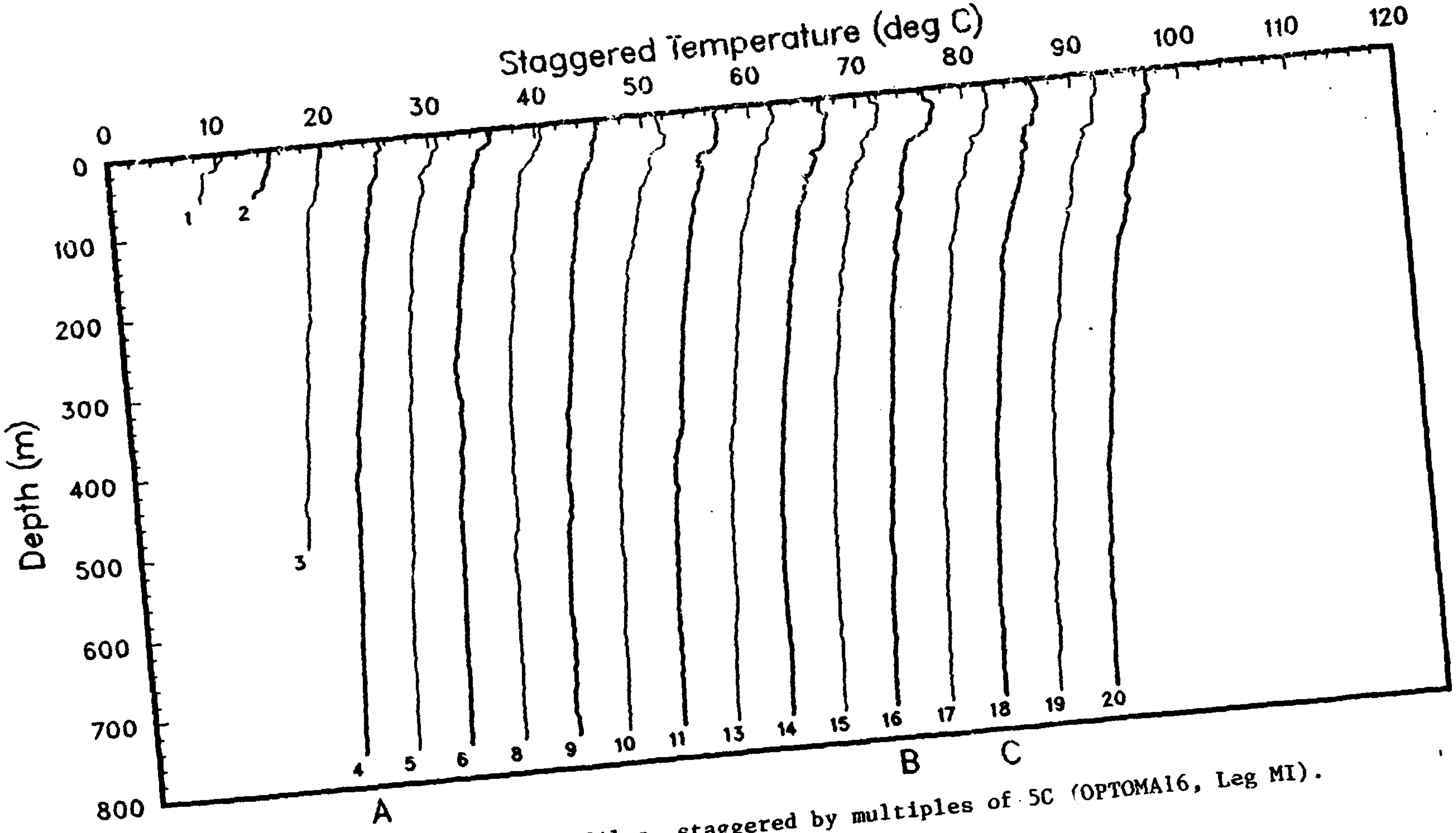


Figure 5(a): XBT temperature profiles, staggered by multiples of 5C (OPTOMA16, Leg MI).

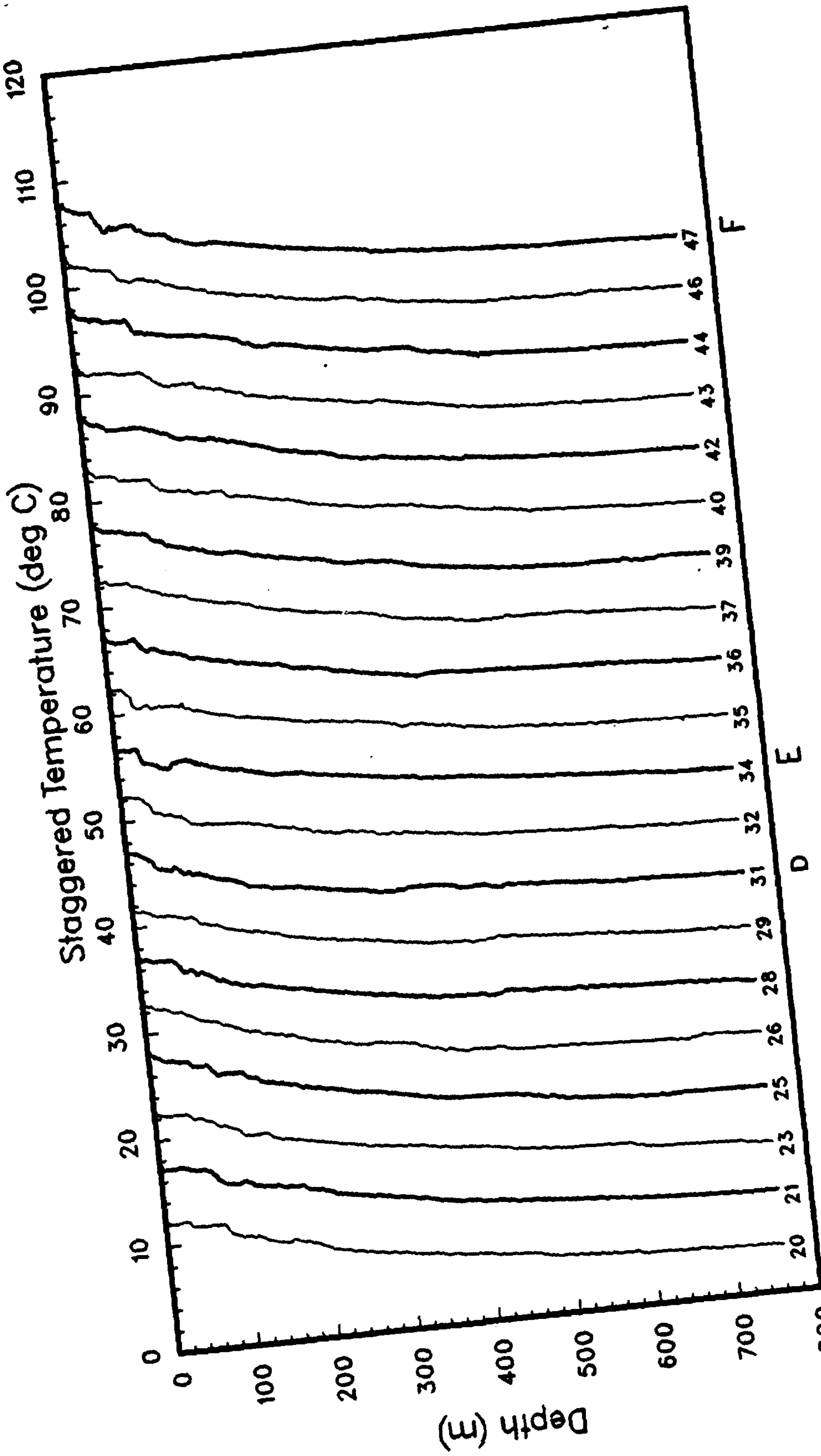

Staggered Temperature (deg C)
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
0
100
200
300
400
500
600
700
800
20
21
23
25
26
28
29
31
32
34
35
36
37
39
40
42
43
44
46
47
C
D
E
F

Figure 5(b)

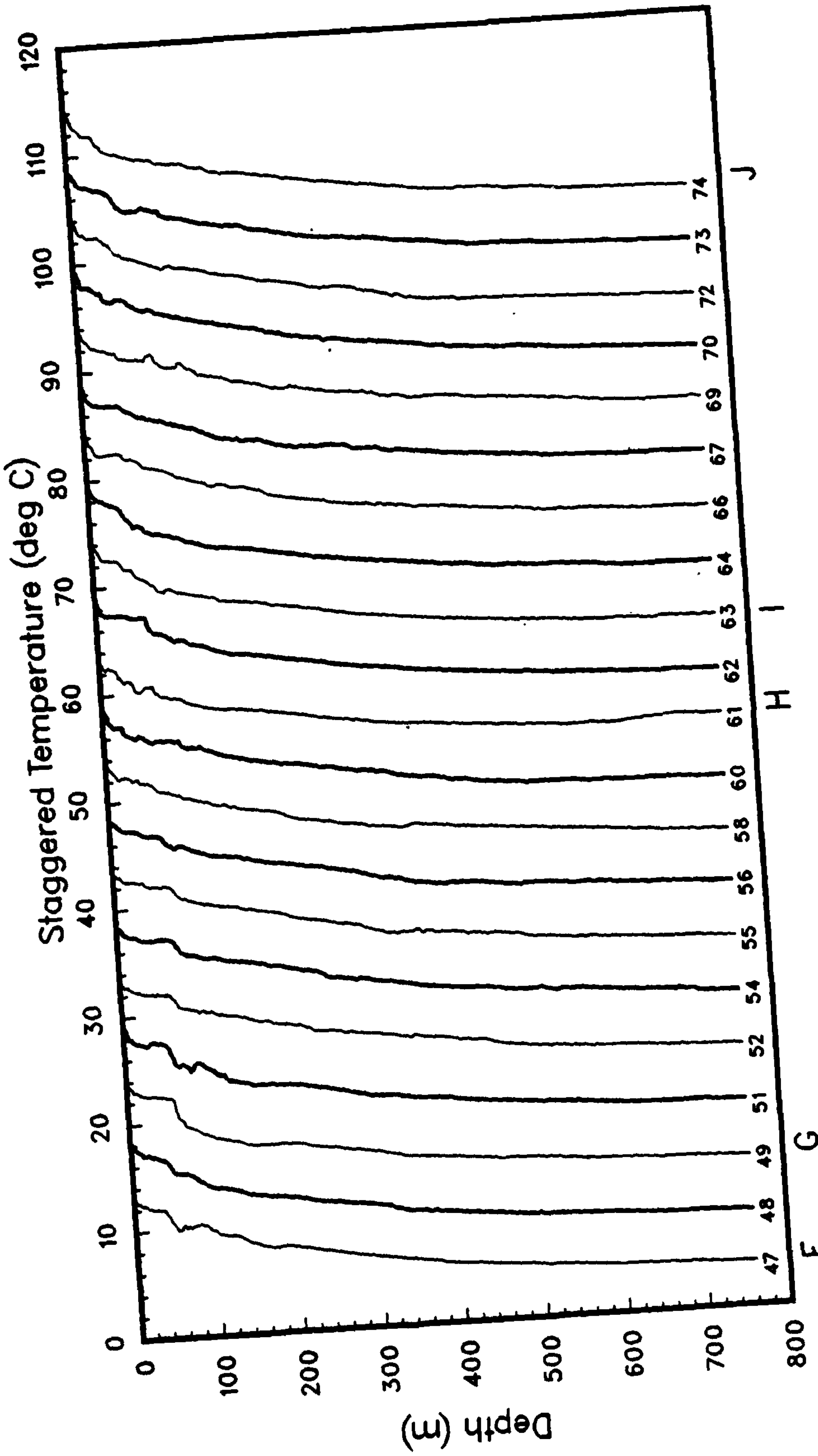
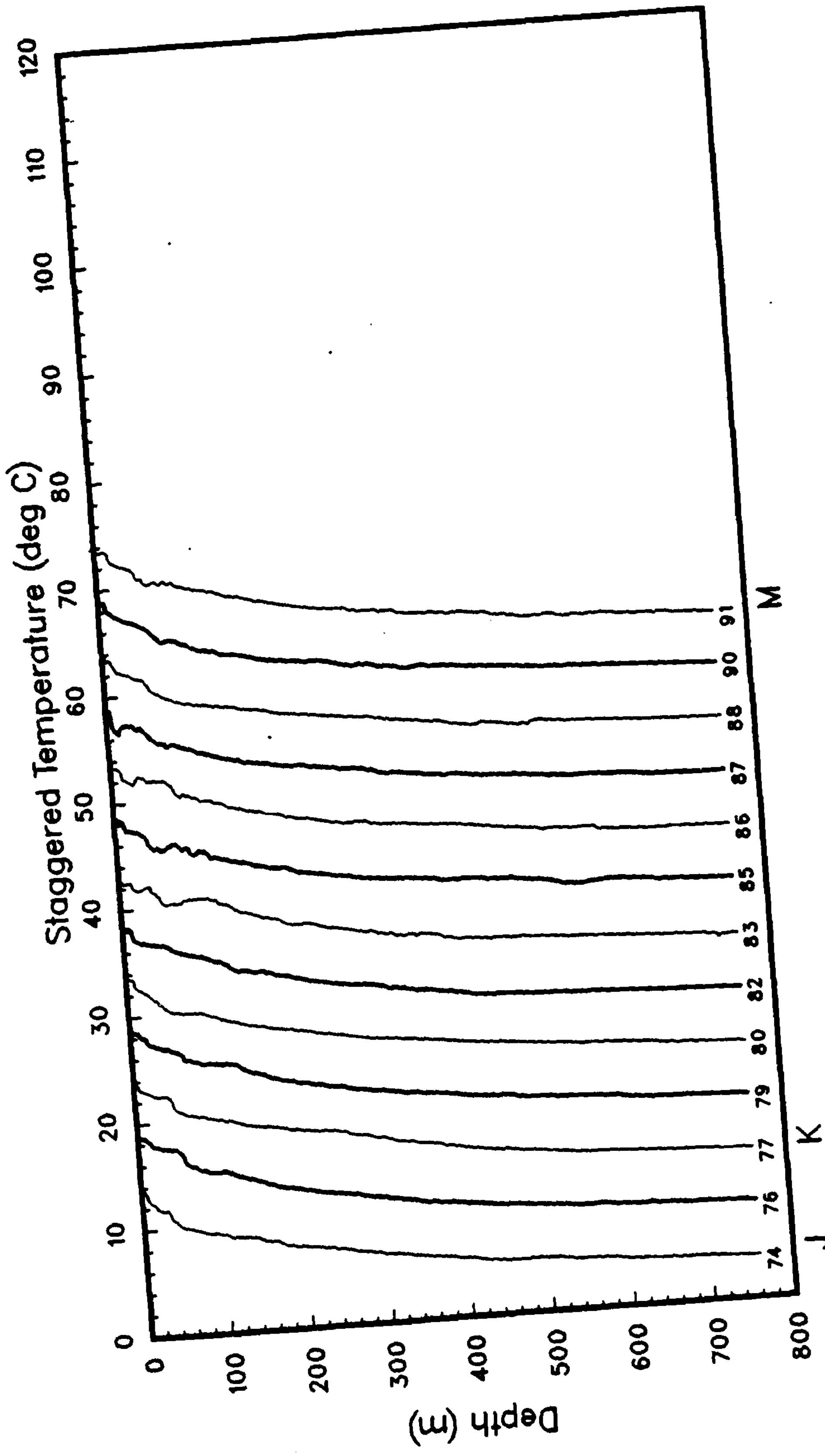

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
47
48
49
51
52
54
55
56
58
60
61
62
63
64
66
67
69
70
72
73
74
F
G
H
I
J

Figure 5(c)



Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
74
76
77
79
80
82
83
85
86
87
88
90
91
J
K
M

Figure 5(d)

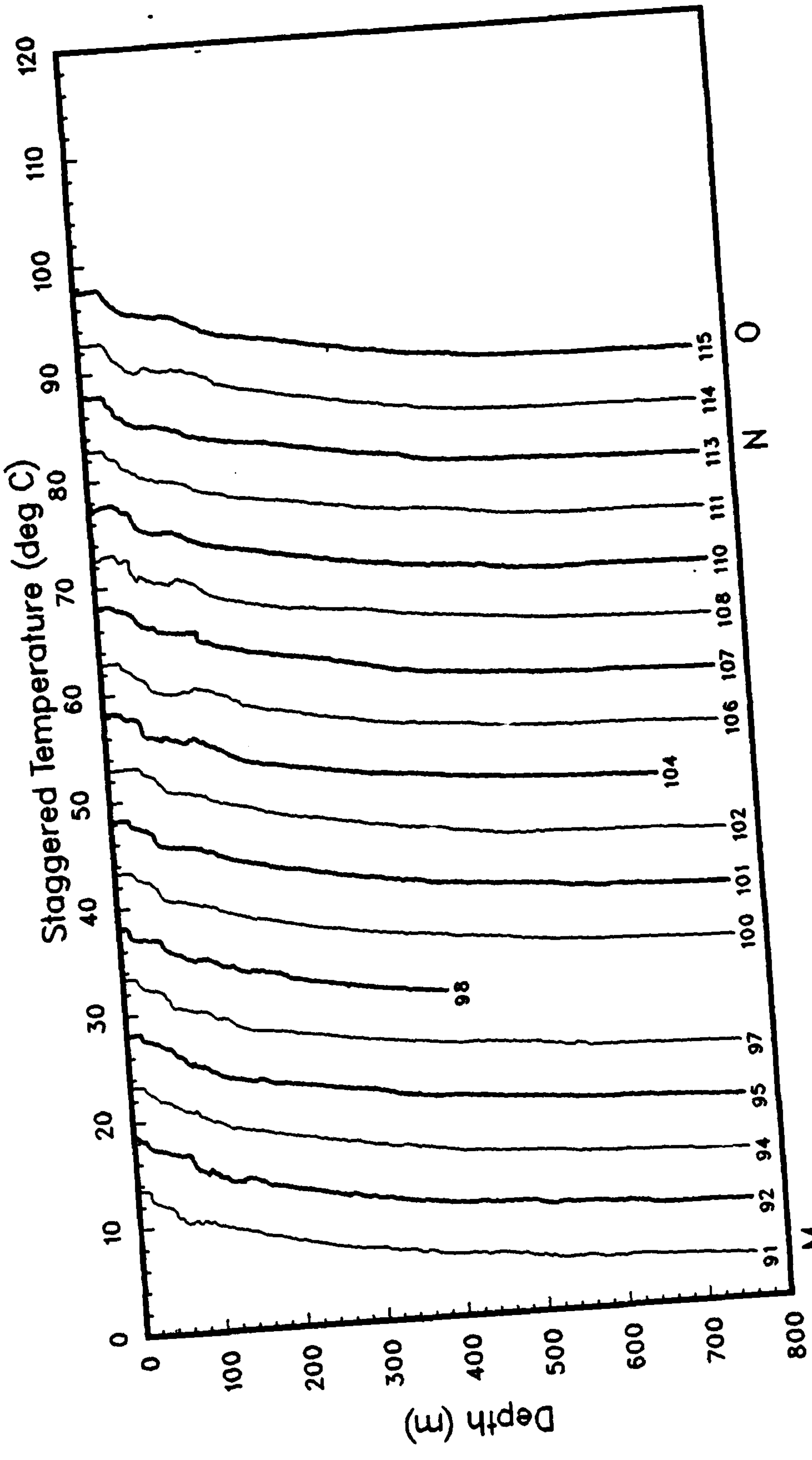

Staggered Temperature (deg C)
0 10 20 30 40 50 60 70 80 90 100 110 120
Depth (m)
0 100 200 300 400 500 600 700 800
91 92 94 95 97 98 100 101 102 104 106 107 108 110 111 113 114 115
M
N
O

Figure 5(e)

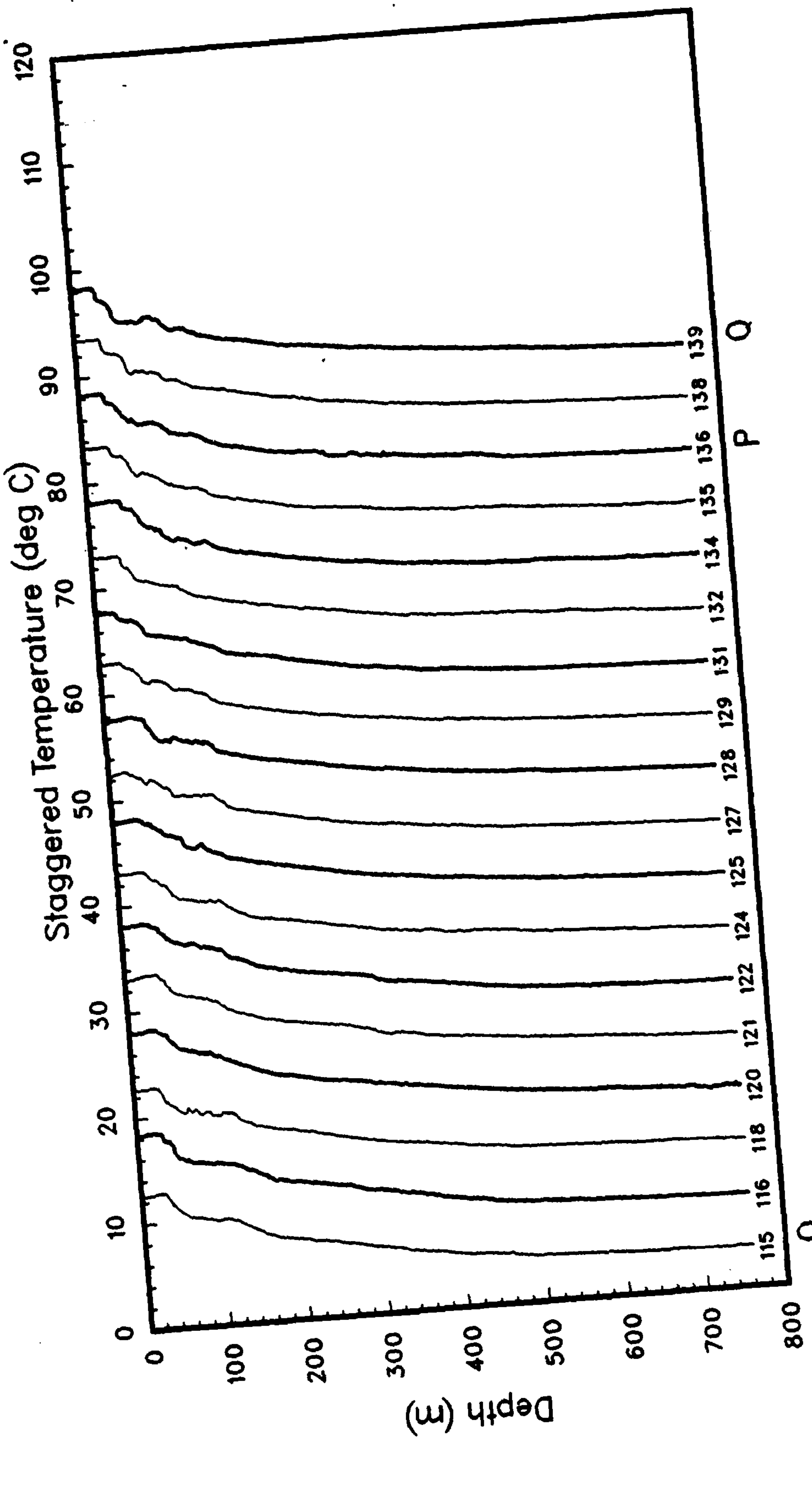

Staggered Temperature (deg C)
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
0
100
200
300
400
500
600
700
800
115
116
118
120
121
122
124
125
127
128
129
131
132
134
135
136
138
139
O
P
Q

Figure 5(f)

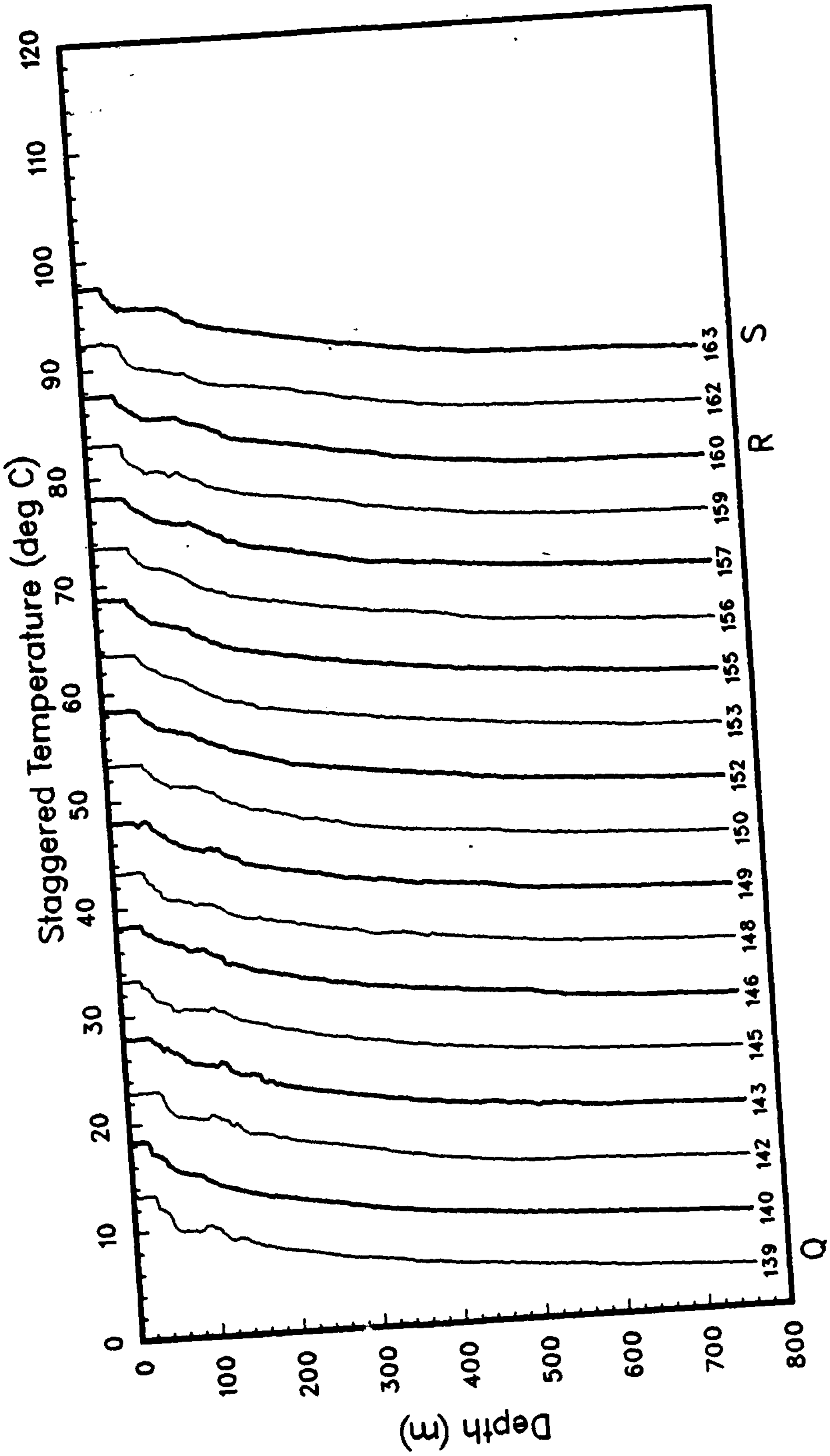
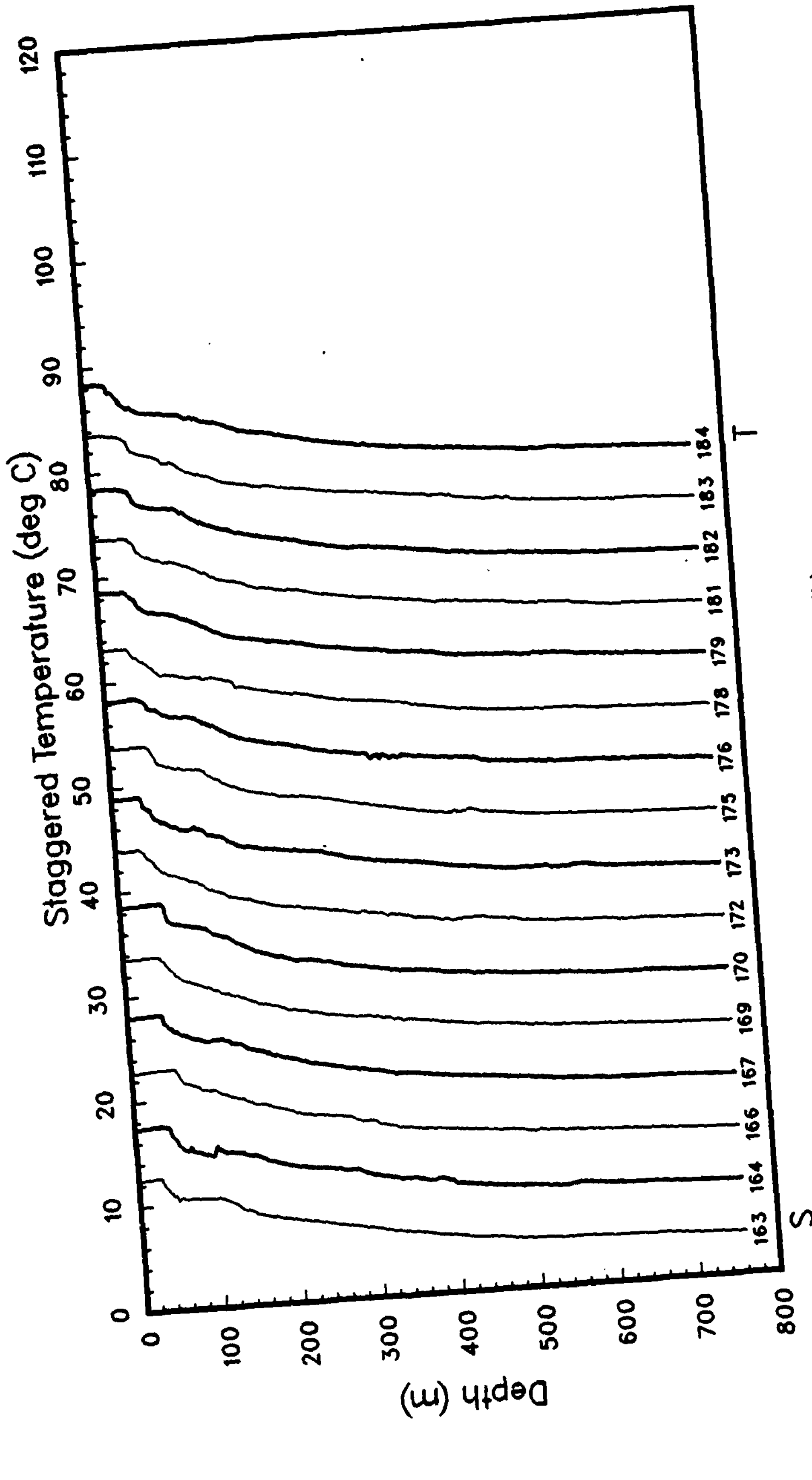
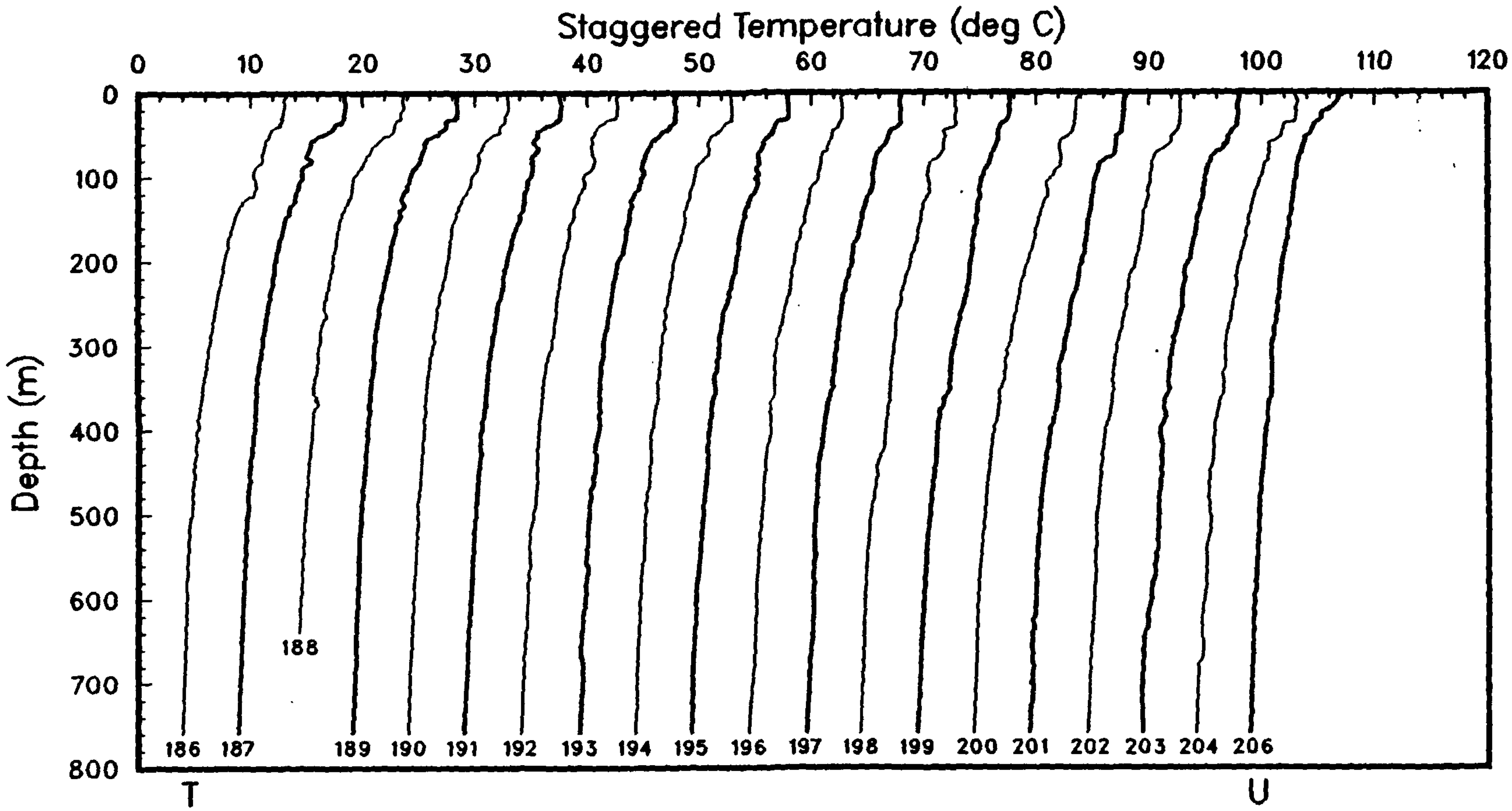

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
139
140
142
143
145
146
148
149
150
152
153
155
156
157
159
160
162
163
Q
R
S

Figure 5(g)



Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
163
164
166
167
169
170
172
173
175
176
178
179
181
182
183
184
S
T

Figure 5(h)



Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
206
T
U

Figure 5(1)

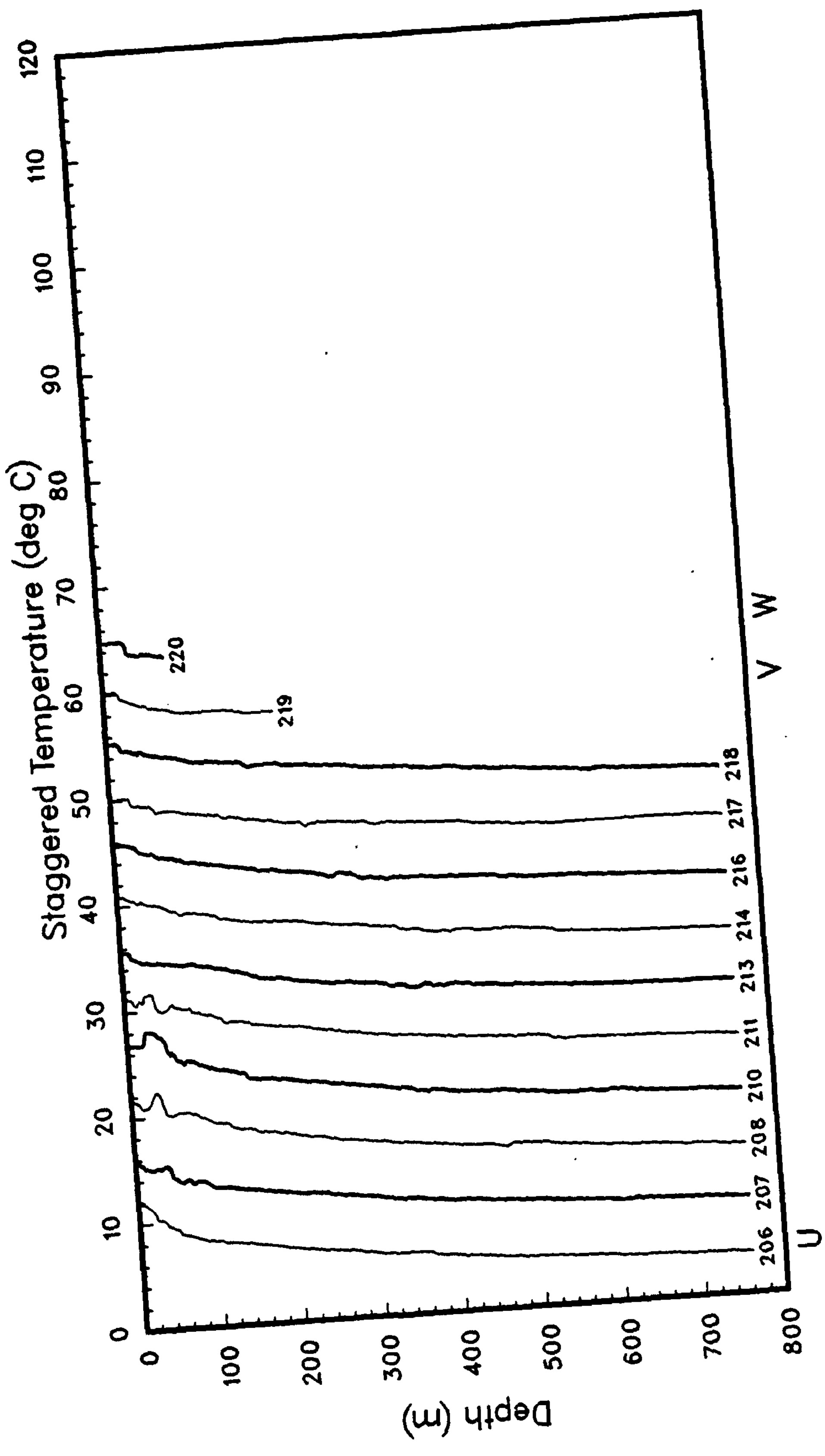

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
206
207
208
210
211
213
214
216
217
218
219
220
U
V
W

Figure 5(j)

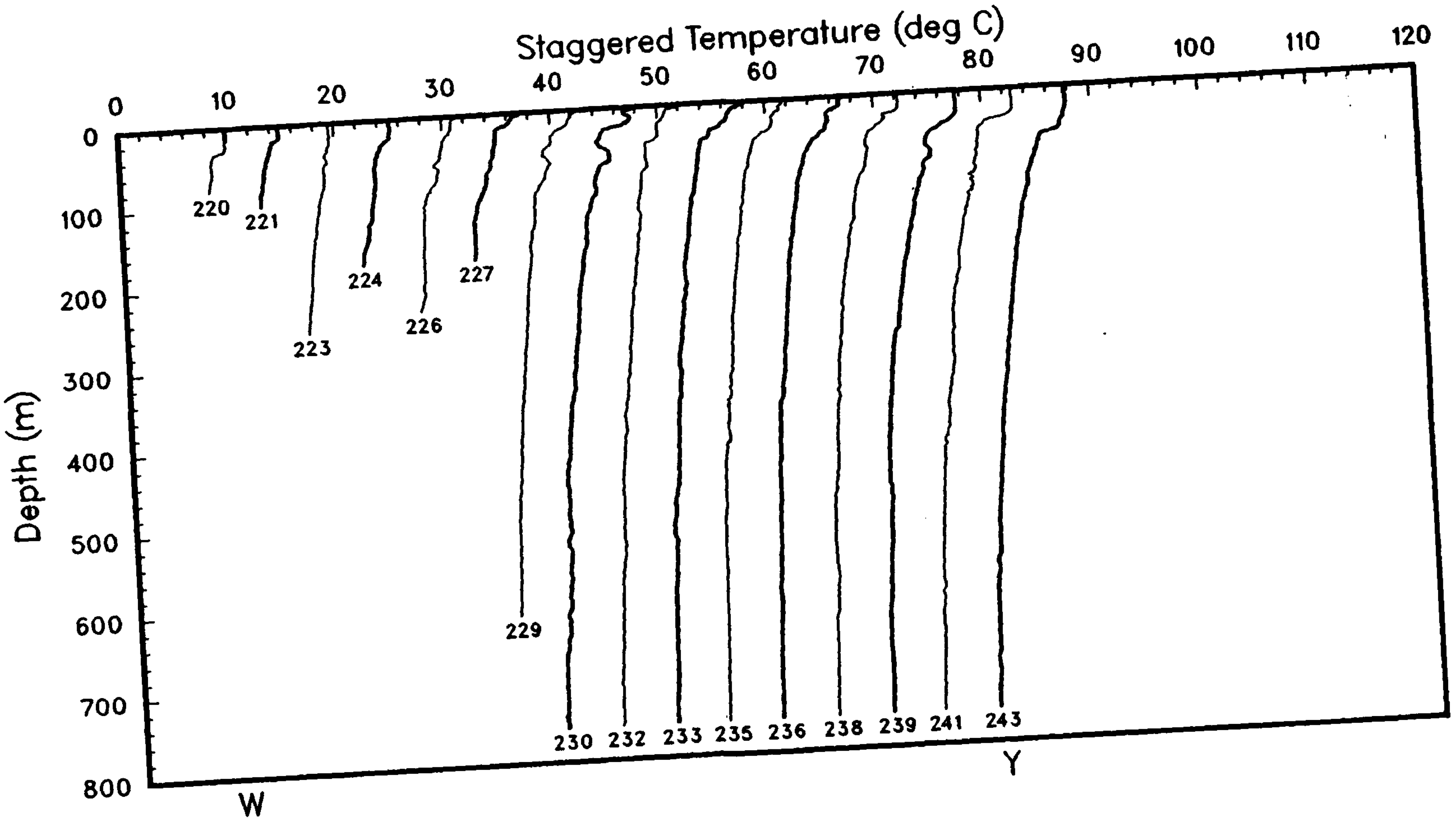

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
220
221
223
224
226
227
229
230
232
233
235
236
238
239
241
243
W
Y

Figure 5(k)

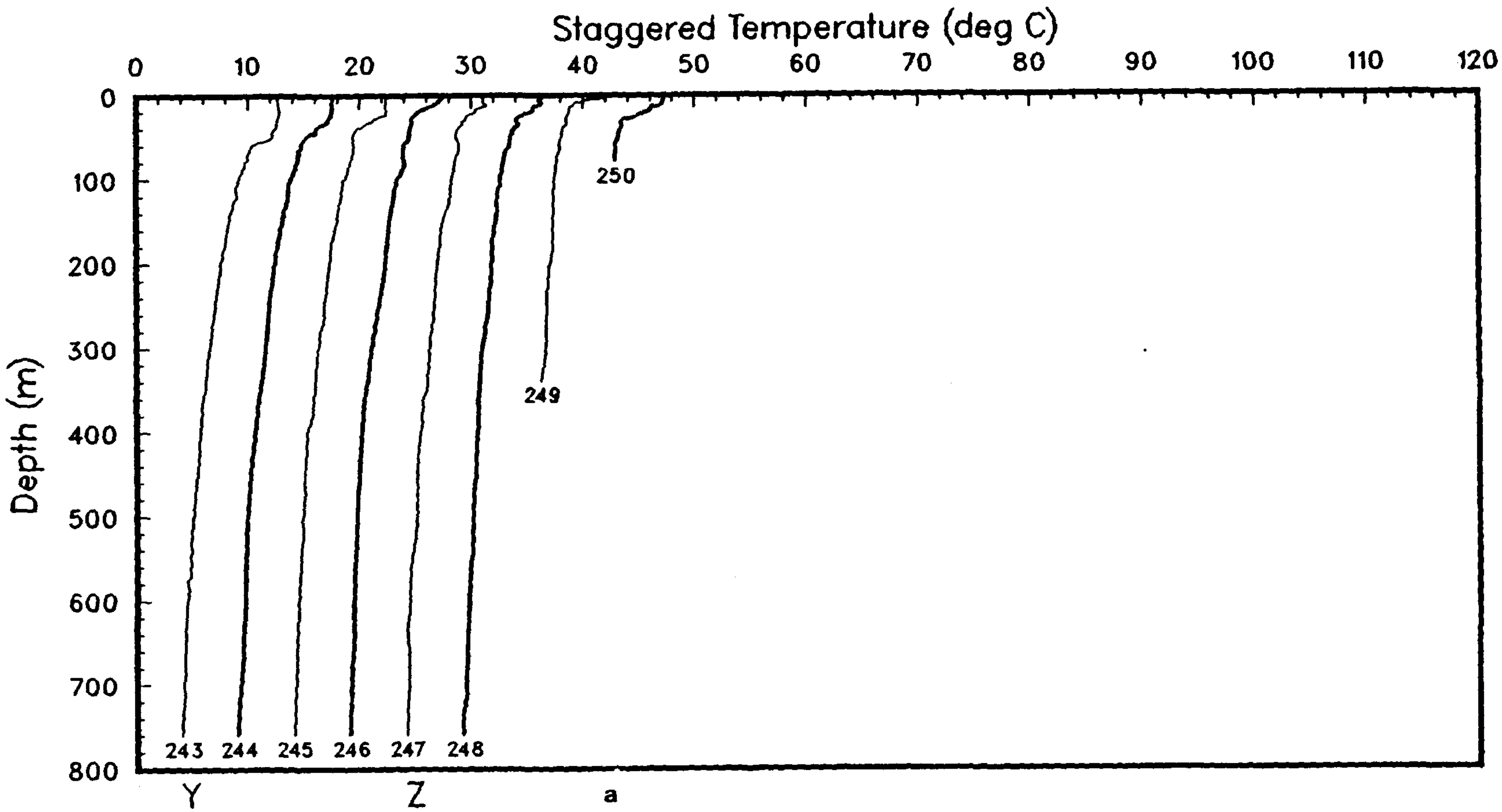

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
250
249
243
244
245
246
247
248
Y
Z
a

Figure 5(1)

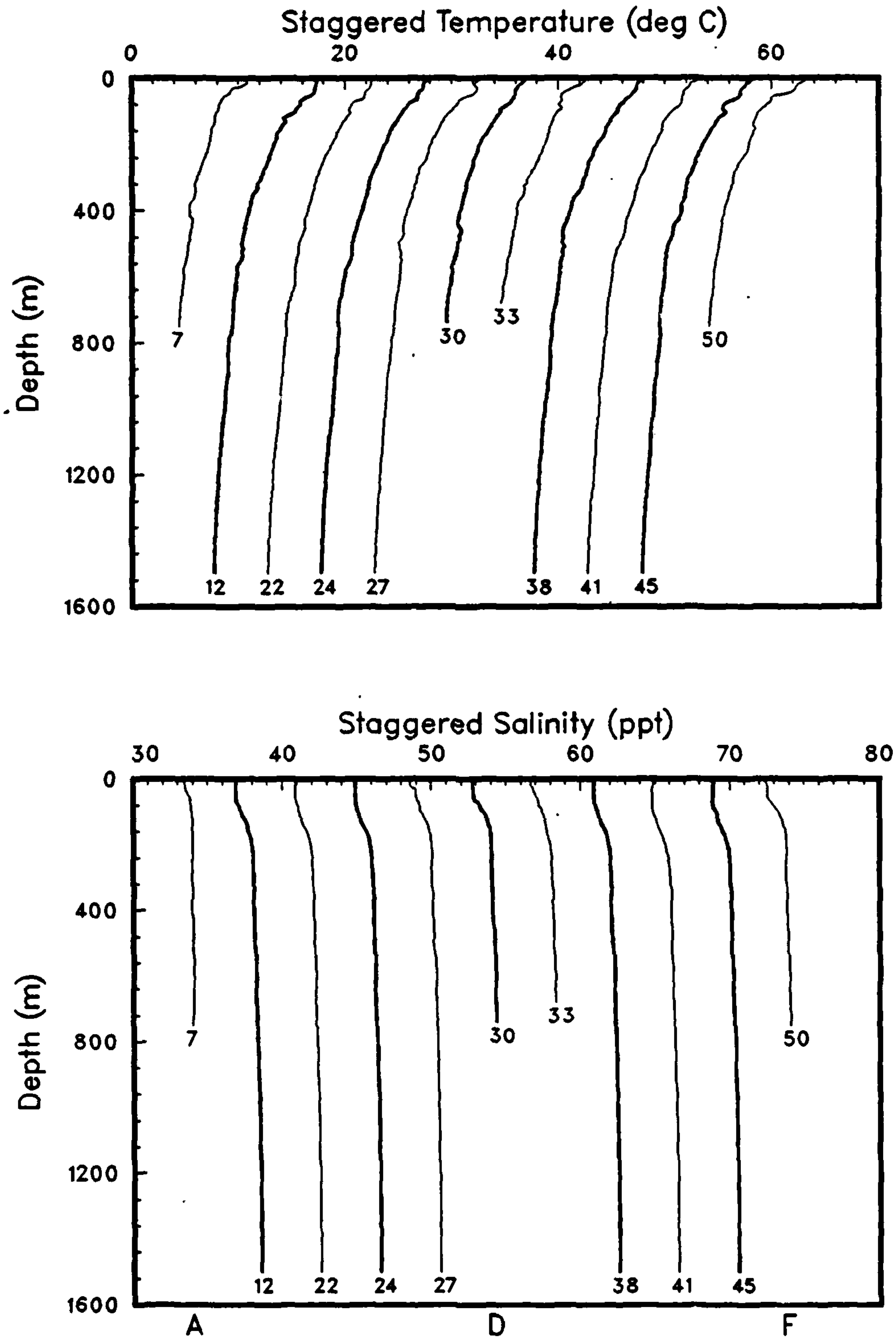


Figure 6(a): CTD temperature profiles, staggered by multiples of 5C, and salinity profiles, staggered by multiples of 4 ppt (OPTOMA16, Leg MI).

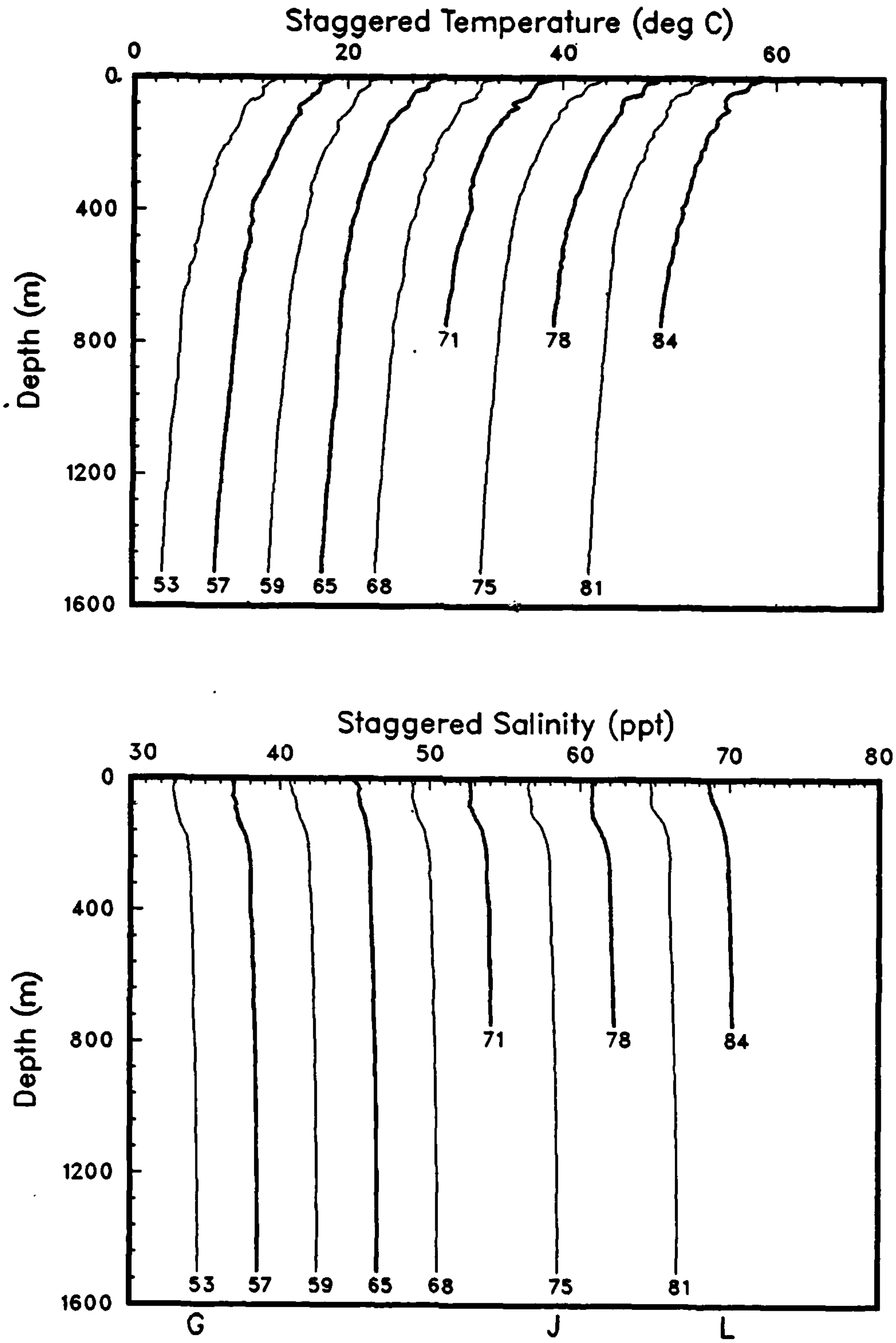

Staggered Temperature (deg C)
0
20
40
60
Depth (m)
400
800
1200
1600
53
57
59
65
68
71
75
78
81
84
Staggered Salinity (ppt)
30
40
50
60
70
80
0
G
J
L

Figure 6(b)

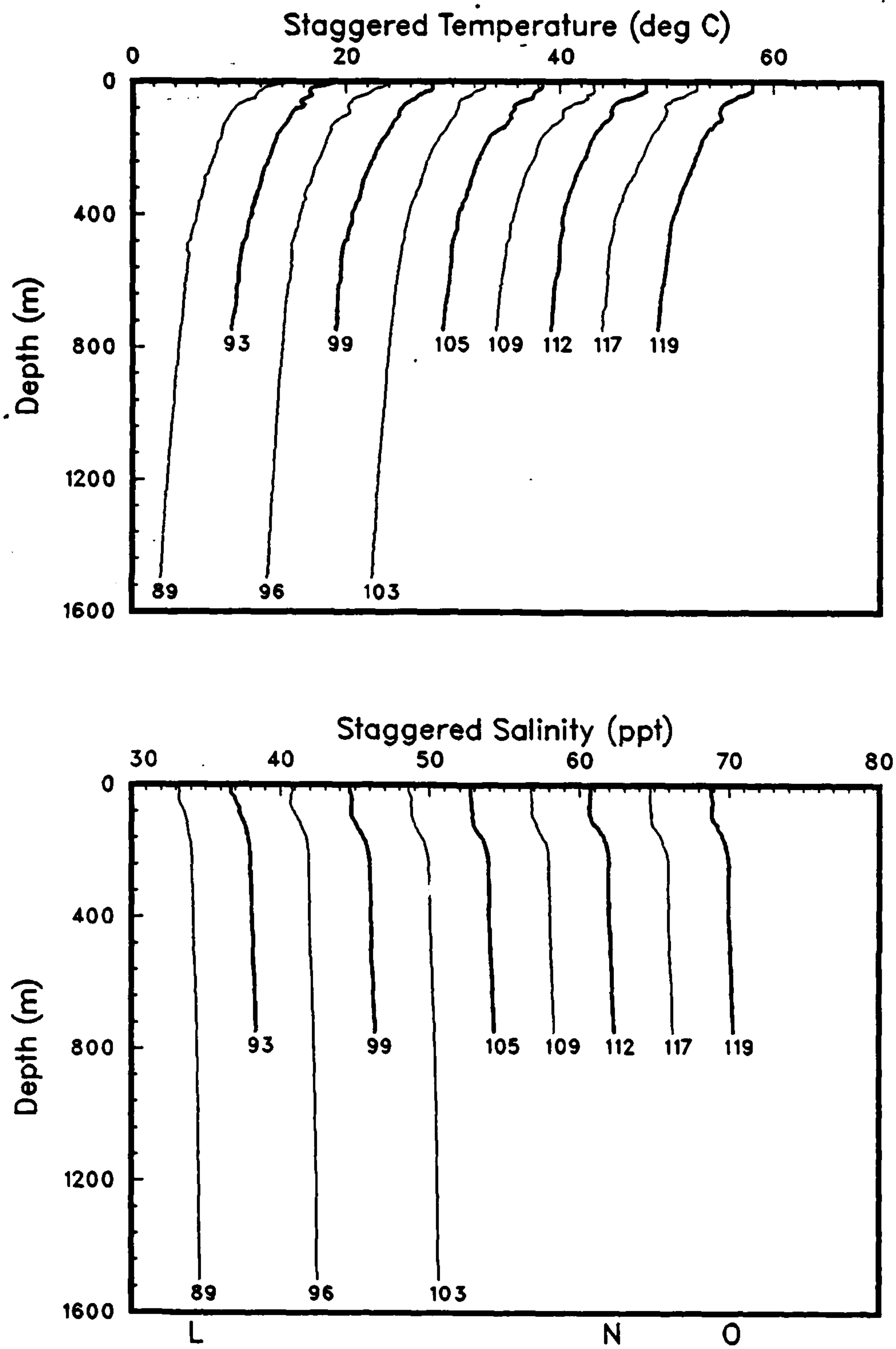

Staggered Temperature (deg C)
0
20
40
60
Depth (m)
0
400
800
1200
1600
93
99
105
109
112
117
119
89
96
103
Staggered Salinity (ppt)
30
40
50
60
70
80
Depth (m)
0
400
800
1200
1600
93
99
105
109
112
117
119
89
96
103
L
N
O

Figure 6(c)

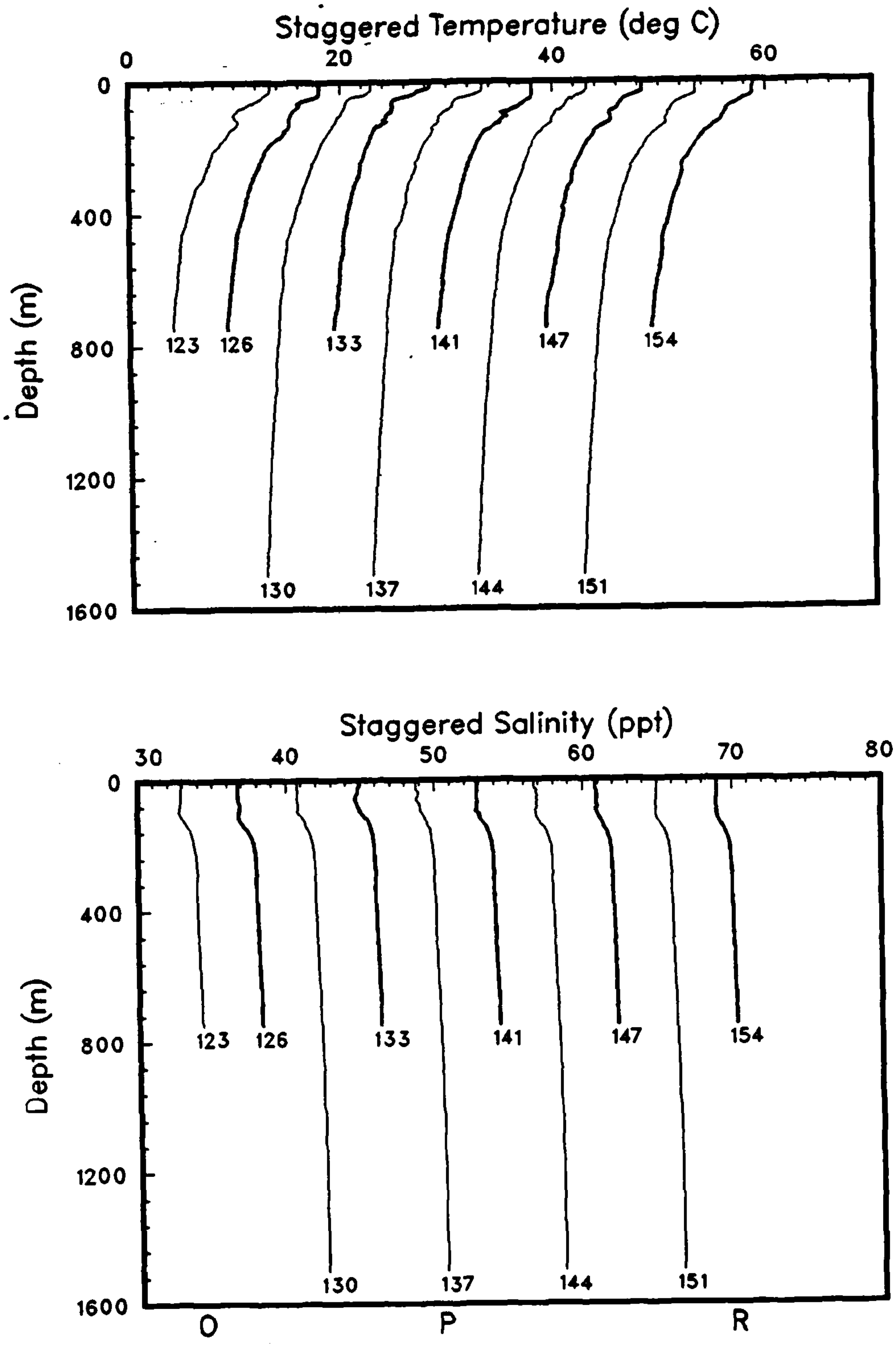

Staggered Temperature (deg C)
0
20
40
60
0
400
800
1200
1600
Depth (m)
123
126
133
141
147
154
130
137
144
151
Staggered Salinity (ppt)
30
40
50
60
70
80
0
400
800
1200
1600
Depth (m)
123
126
133
141
147
154
130
137
144
151
O
P
R

Figure 6(d)

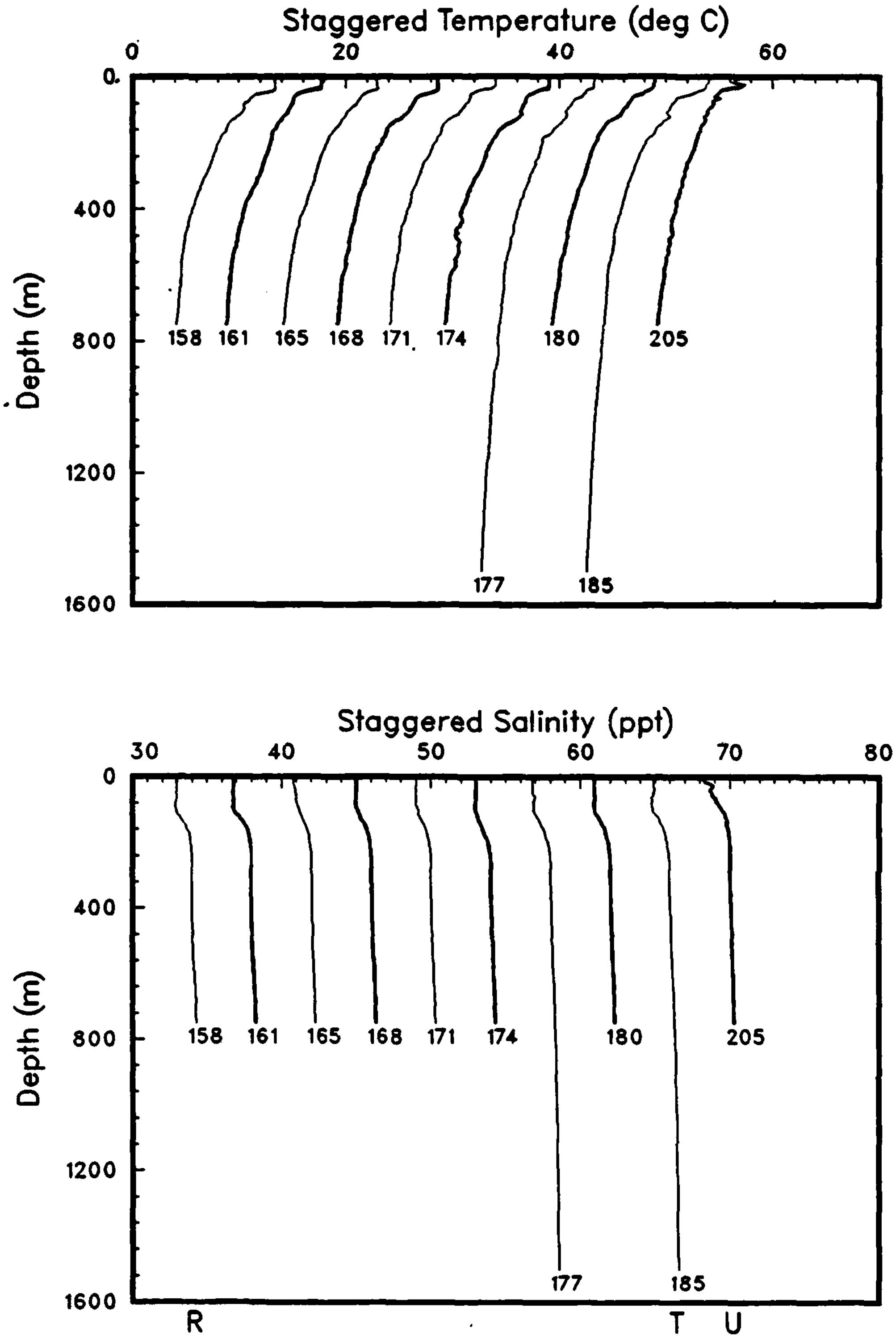

Staggered Temperature (deg C)
0
20
40
60
0
400
800
1200
1600
Depth (m)
158
161
165
168
171
174
180
205
177
185
Staggered Salinity (ppt)
30
40
50
60
70
80
0
400
800
1200
1600
Depth (m)
158
161
165
168
171
174
180
205
177
185
R
T
U

Figure 6(e)

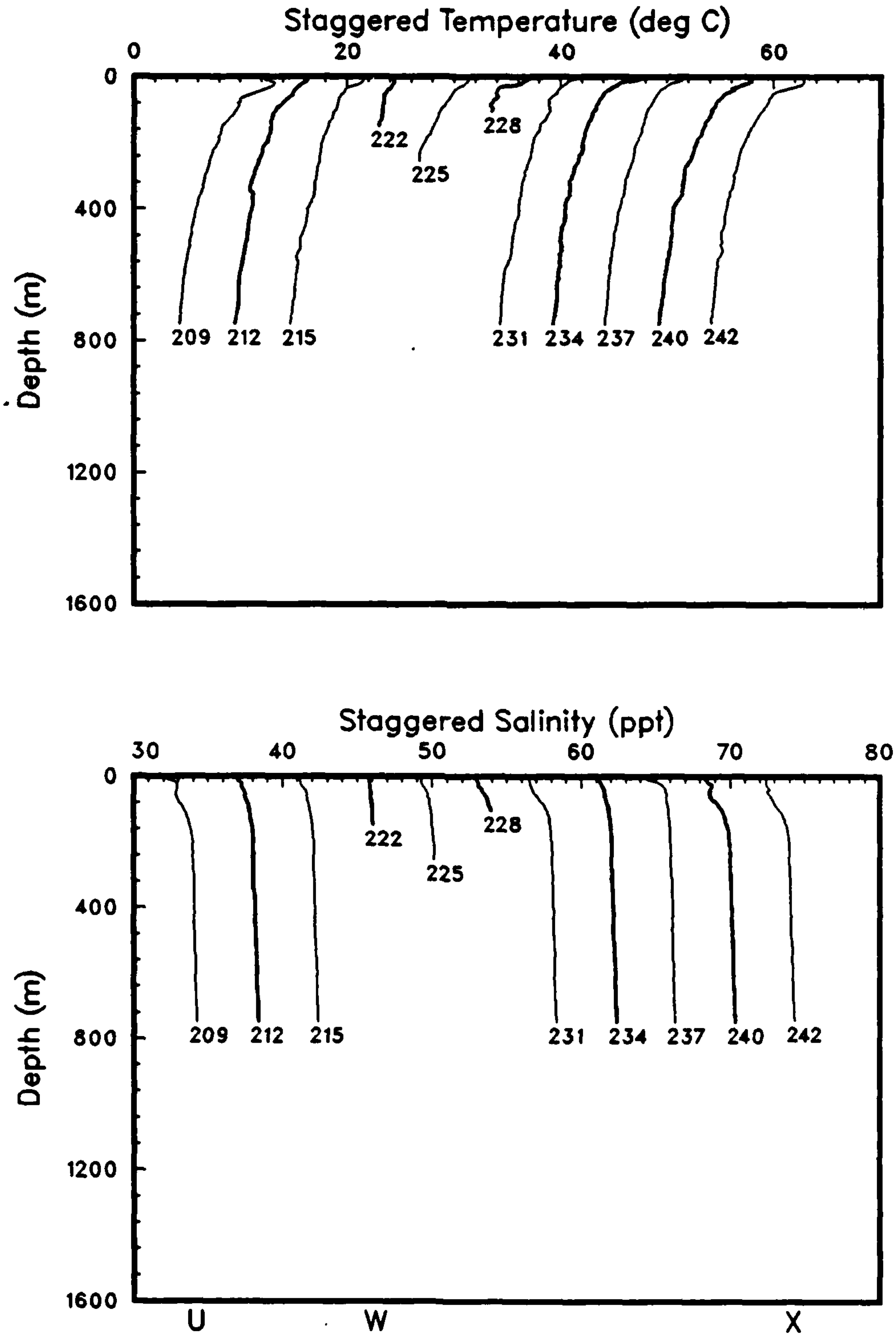
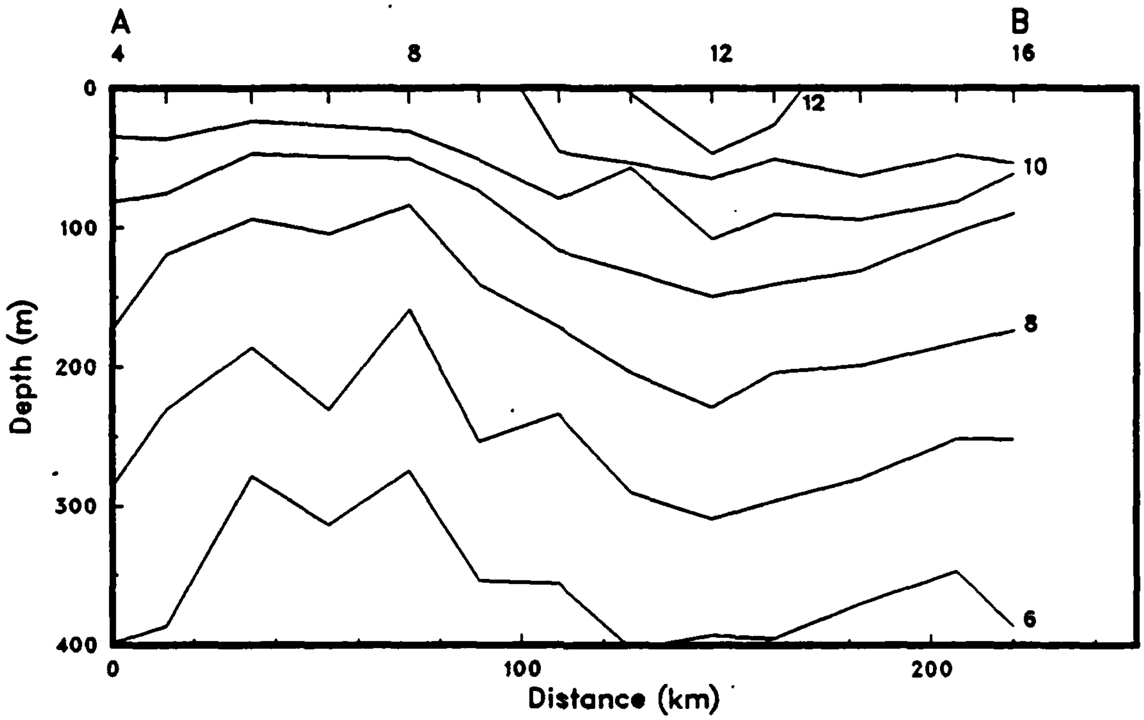

Staggered Temperature (deg C)
0
20
40
60
0
400
800
1200
1600
Depth (m)
222
225
228
209
212
215
231
234
237
240
242
Staggered Salinity (ppt)
30
40
50
60
70
80
0
400
800
1200
1600
Depth (m)
222
225
228
209
212
215
231
234
237
240
242
U
W
X

Figure 6(f)



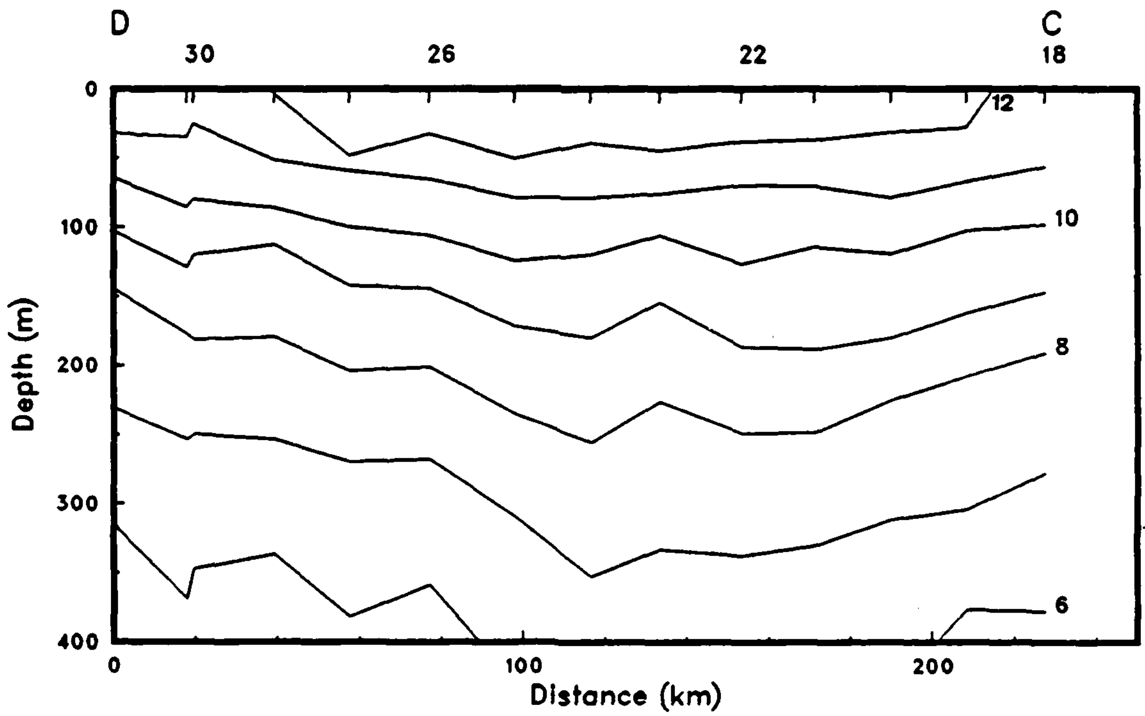


Figure 7(a)-(b): Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow (OPTOMA16, Leg MI).

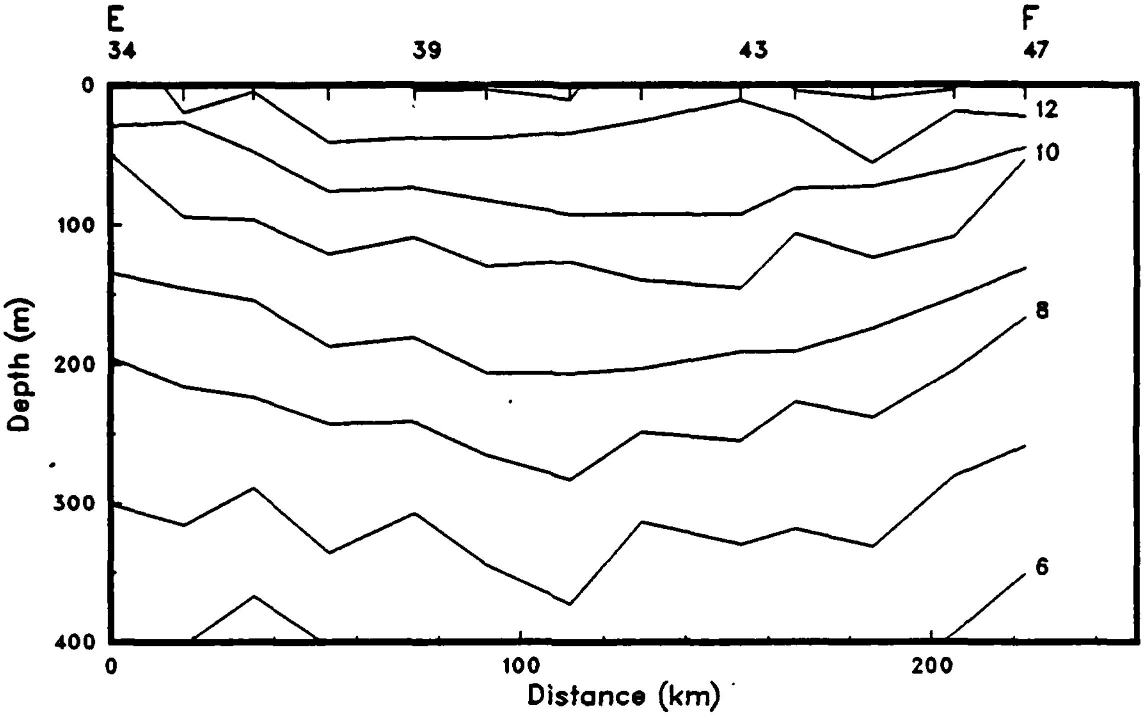


Figure 7(c)

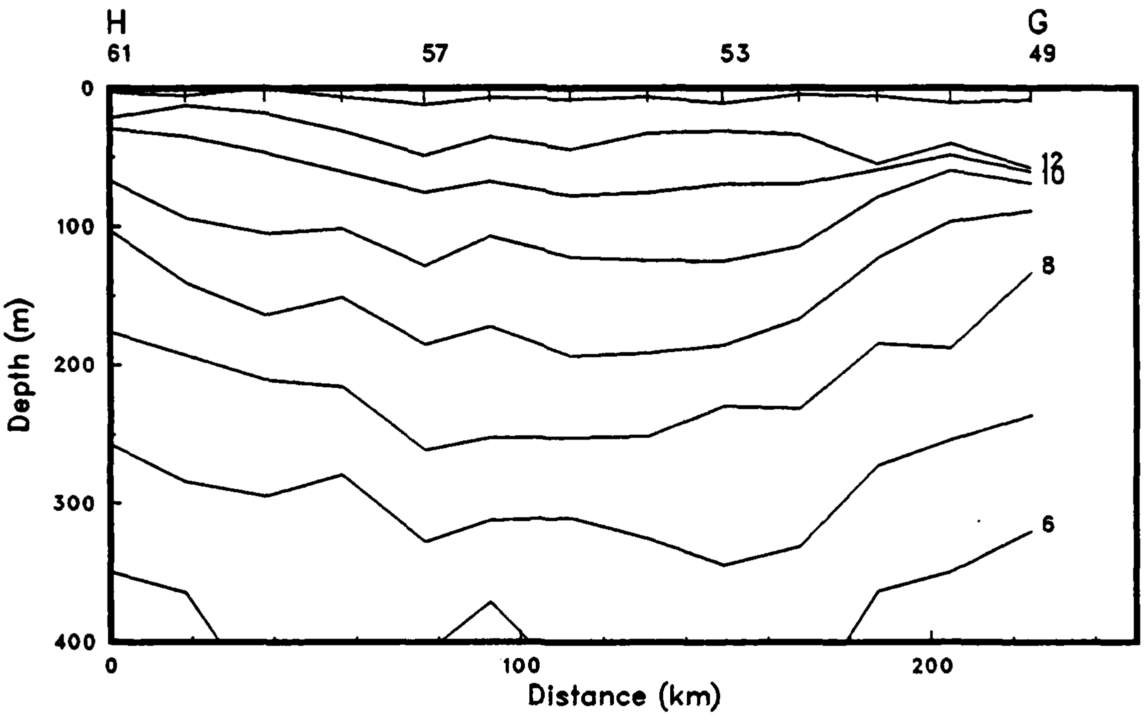


Figure 7(d)

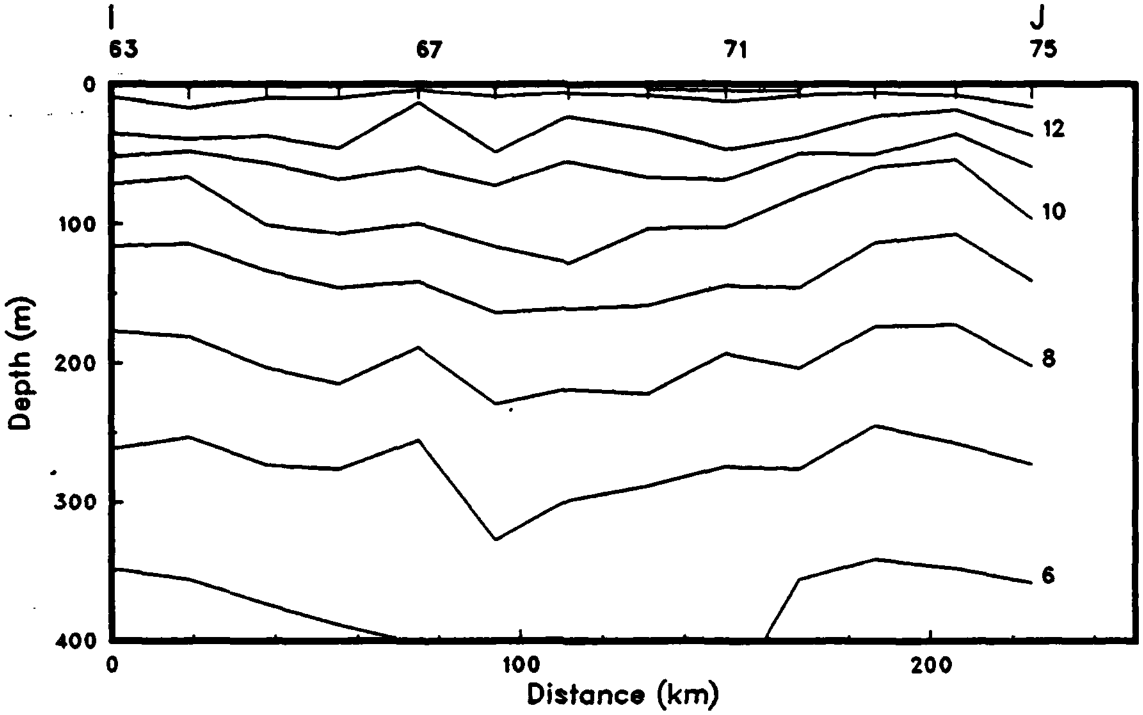


Figure 7(e)

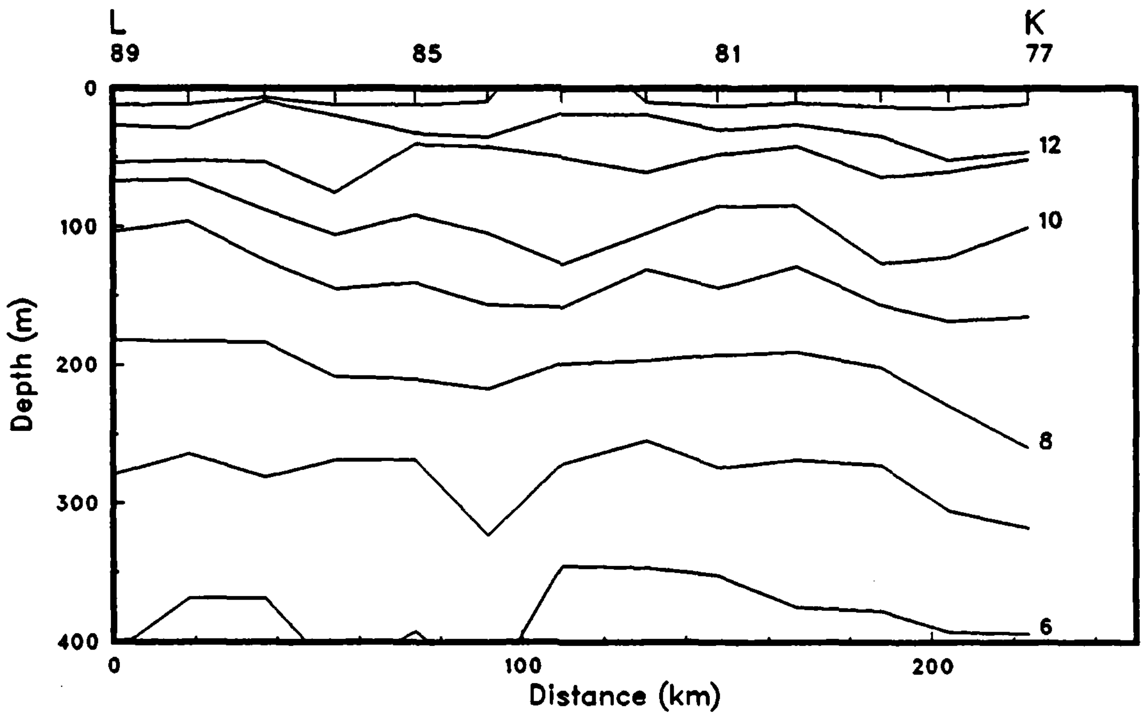


Figure 7(f)

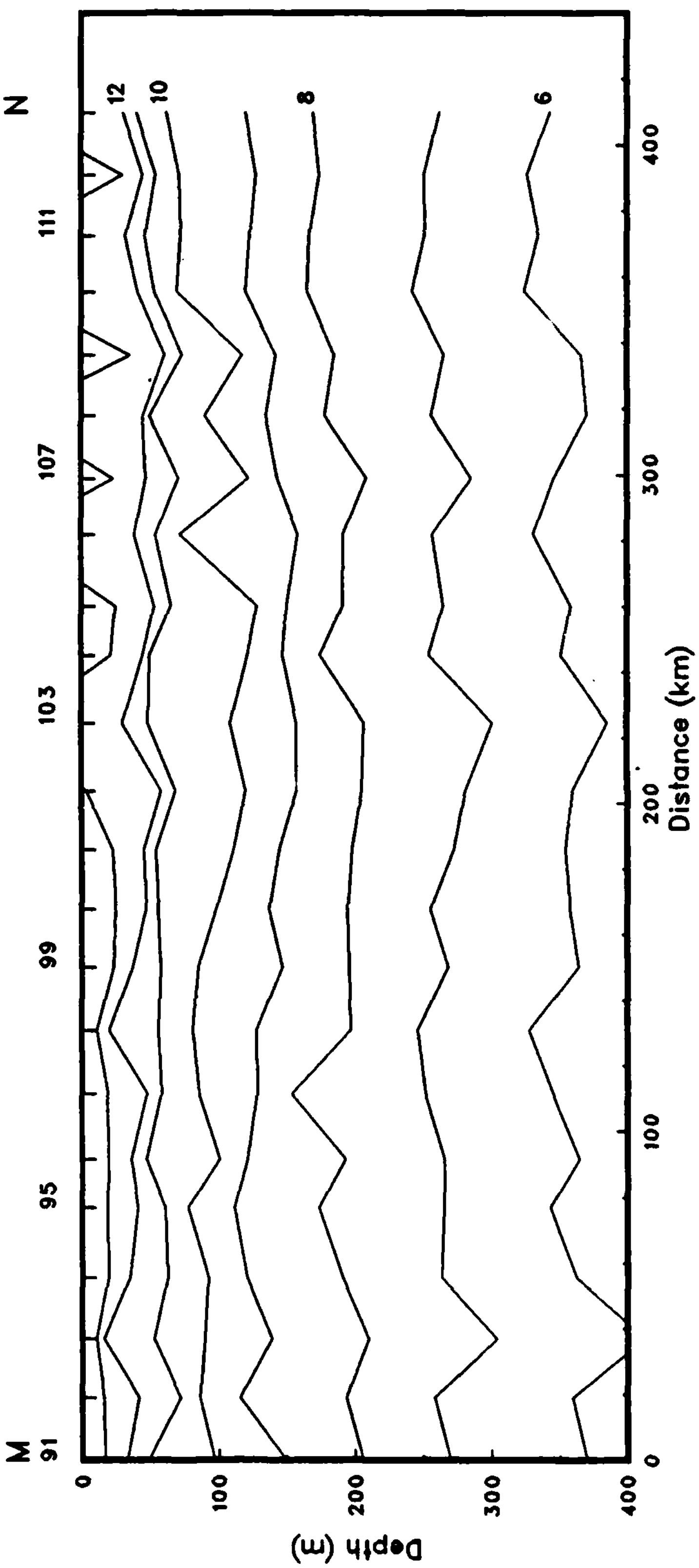

M
N
91
95
99
103
107
111
12
10
8
6
Depth (m)
0
100
200
300
400
Distance (km)
0
100
200
300
400

Figure 7(g)

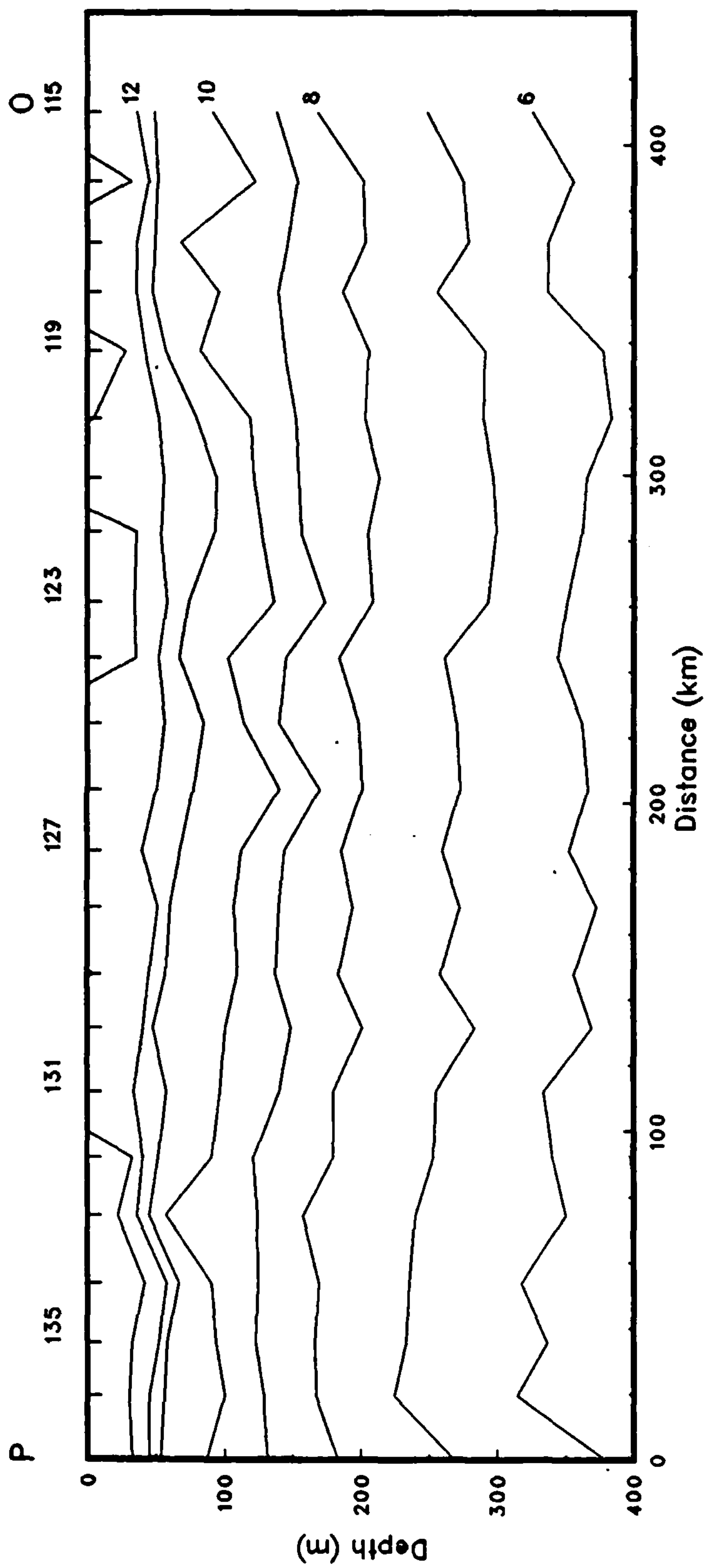

P
O
115
119
123
127
131
135
12
10
8
6
0
100
200
300
400
Depth (m)
Distance (km)

Figure 7(h)

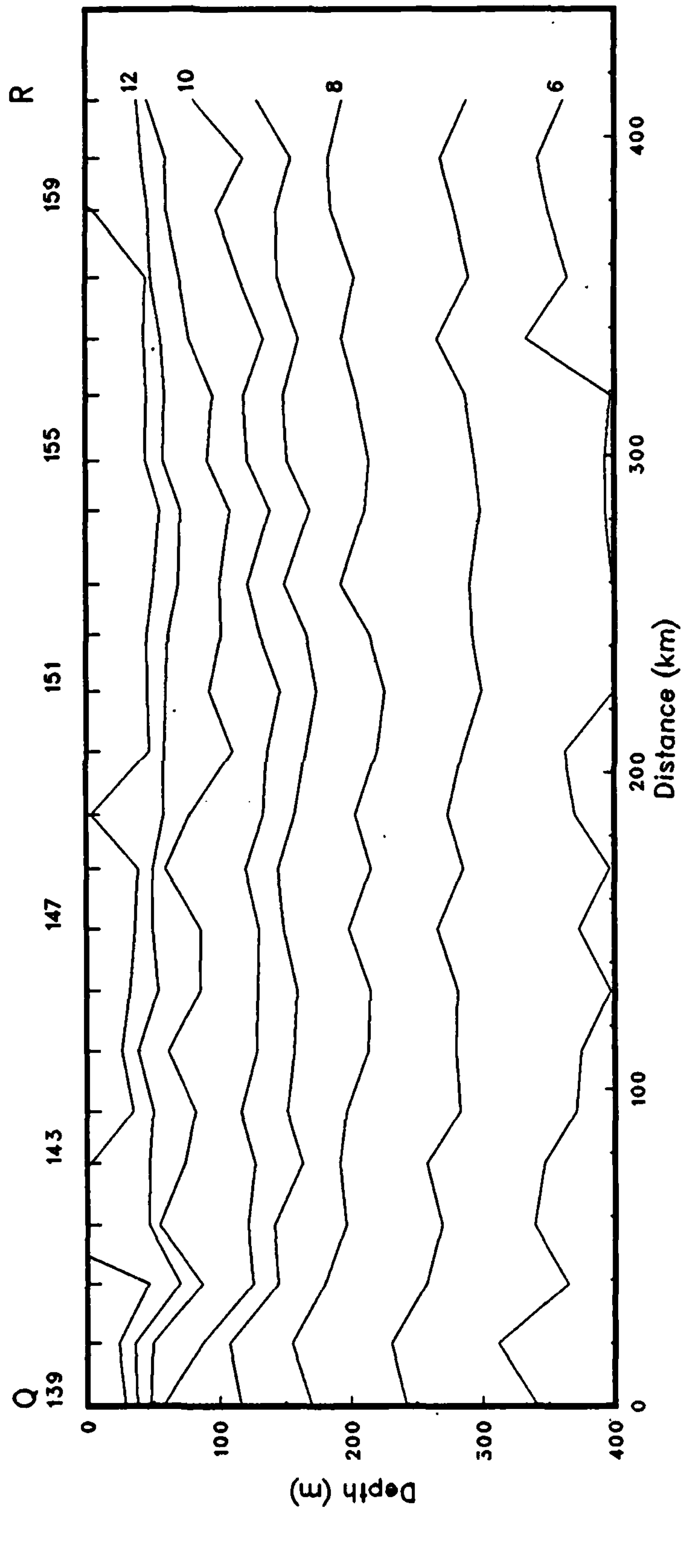

Q
R
139
143
147
151
155
159
12
10
8
6
0
100
200
300
400
Depth (m)
Distance (km)

Figure 7(i)

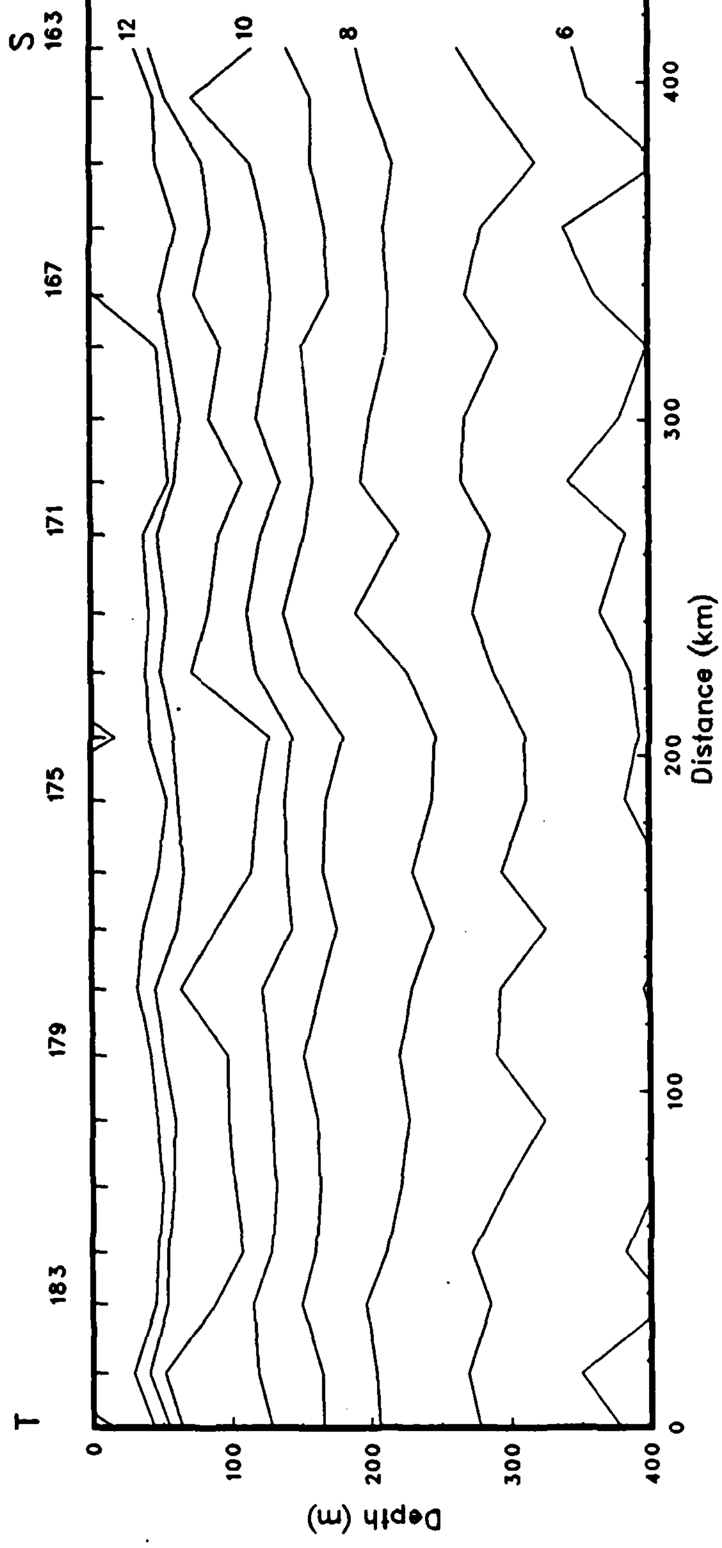

T
S
183
179
175
171
167
163
12
10
8
6
0
100
200
300
400
Depth (m)
Distance (km)

Figure 7(j)

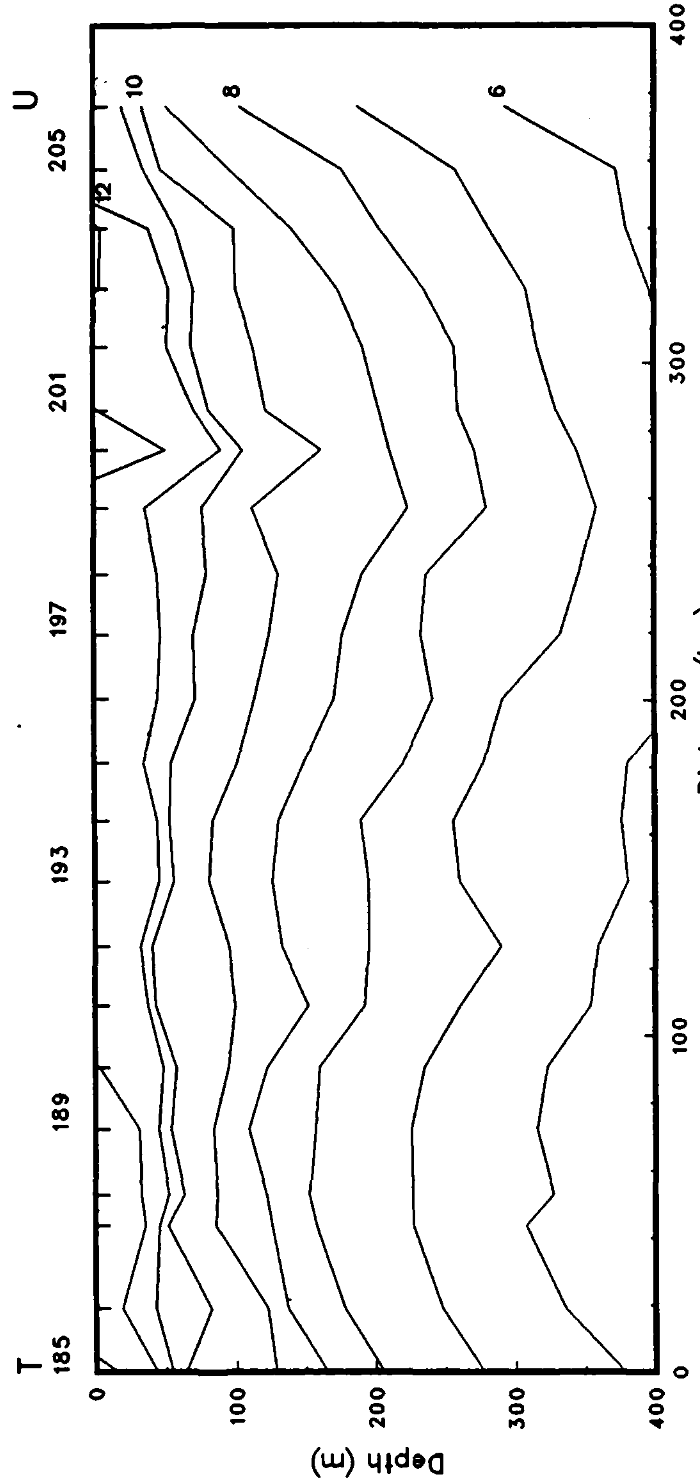

T
185
189
193
197
201
205
U
12
10
8
6
0
100
200
300
400
Depth (m)
Distance (km)

Figure 7(k)

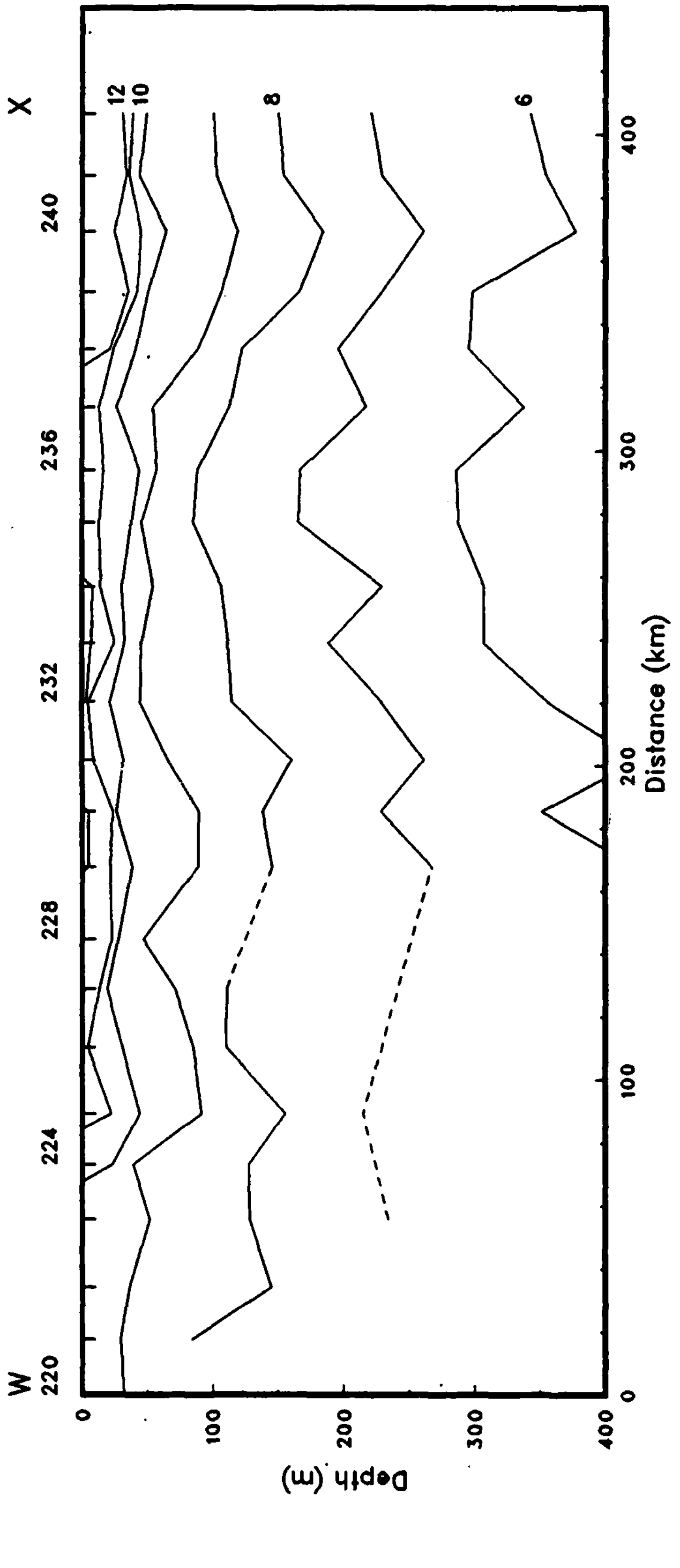

W
X
220
224
228
232
236
240
12
10
8
6
Depth (m)
0
100
200
300
400
Distance (km)
0
100
200
300
400

Figure 7(1)

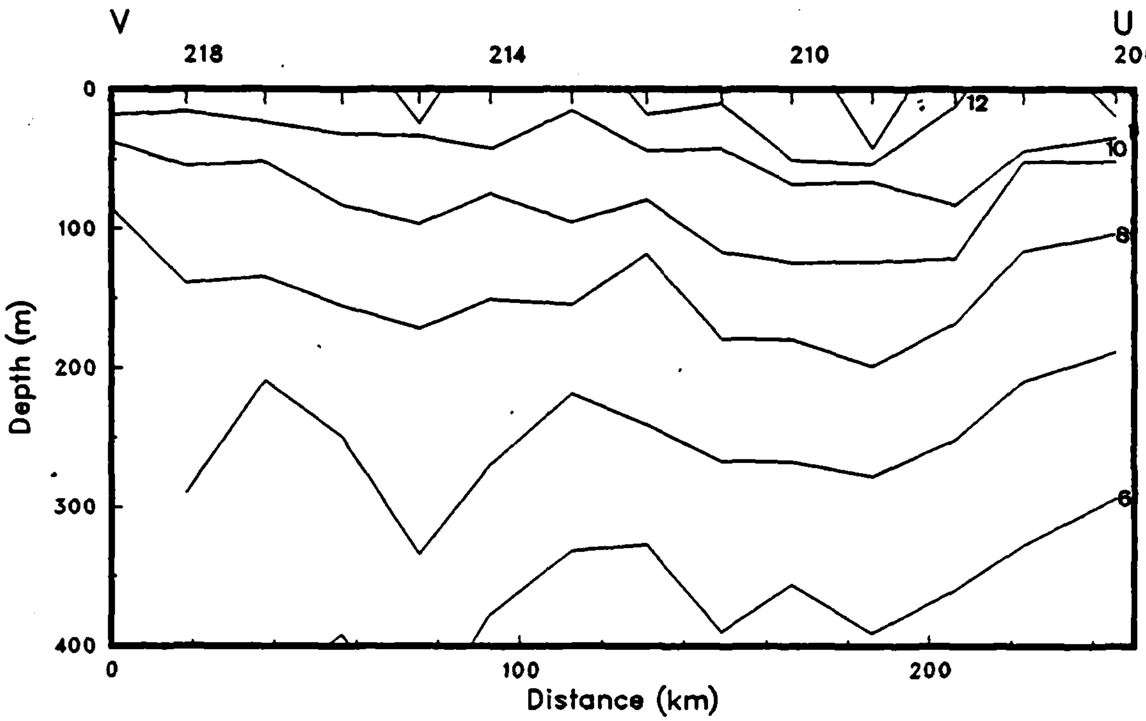


Figure 7(m)

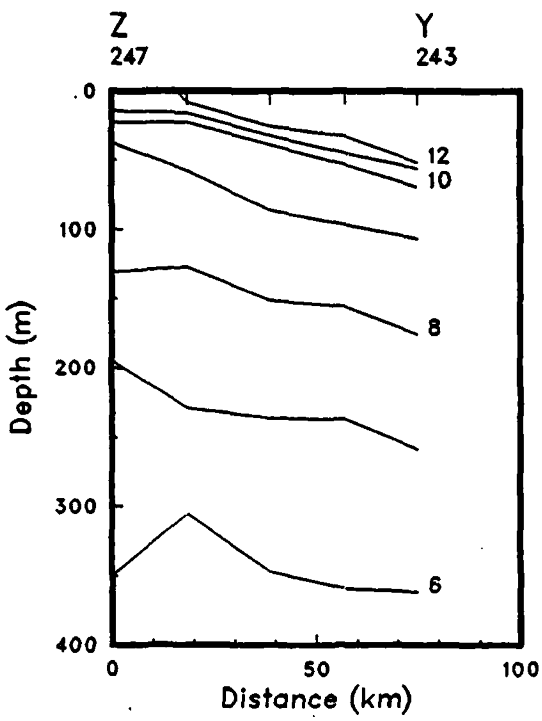


Figure 7(n)

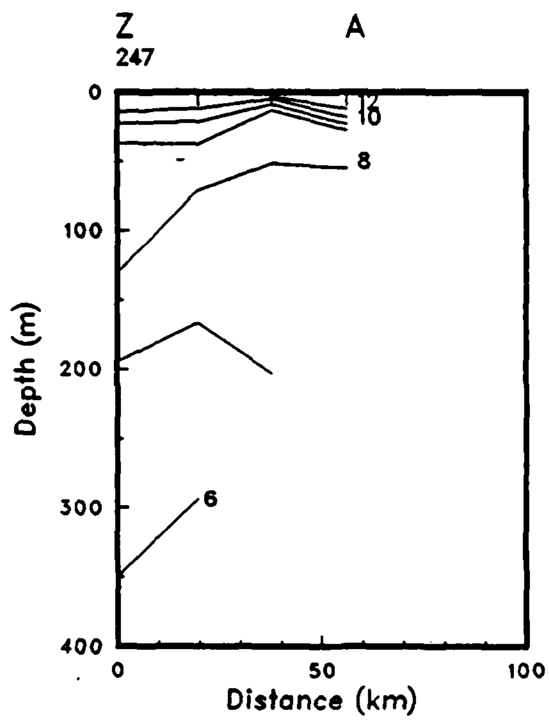
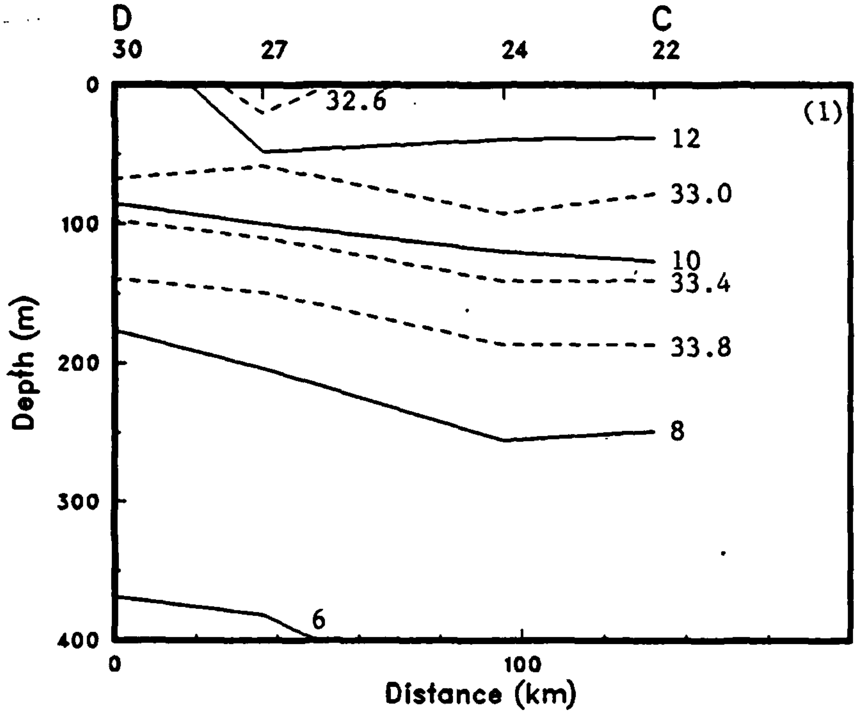


Figure 7(o)



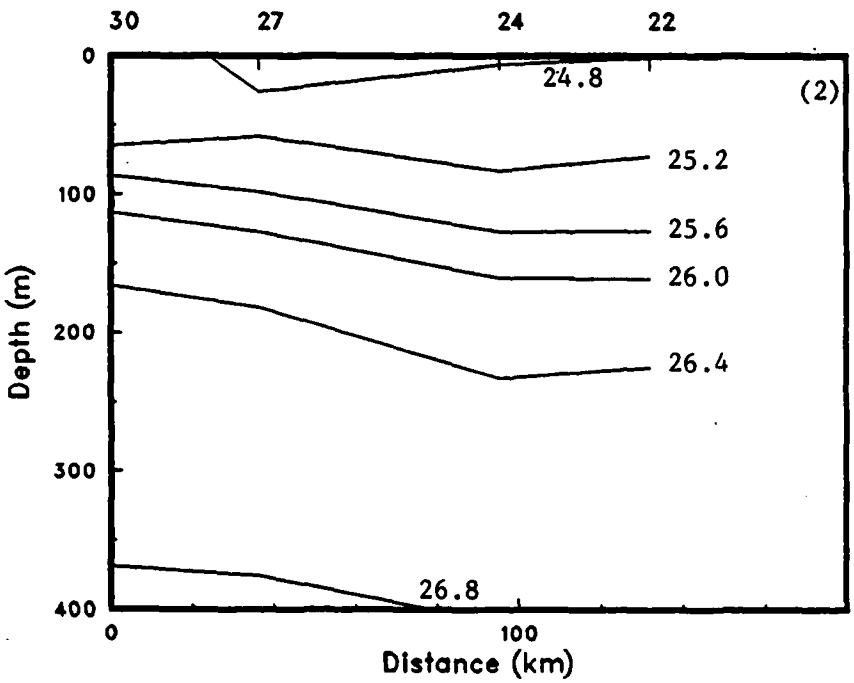


Figure 8(a): Isopleths of (1) temperature and salinity and (2) sigma-t from the CTD's (OPTOMA16, Leg MI).

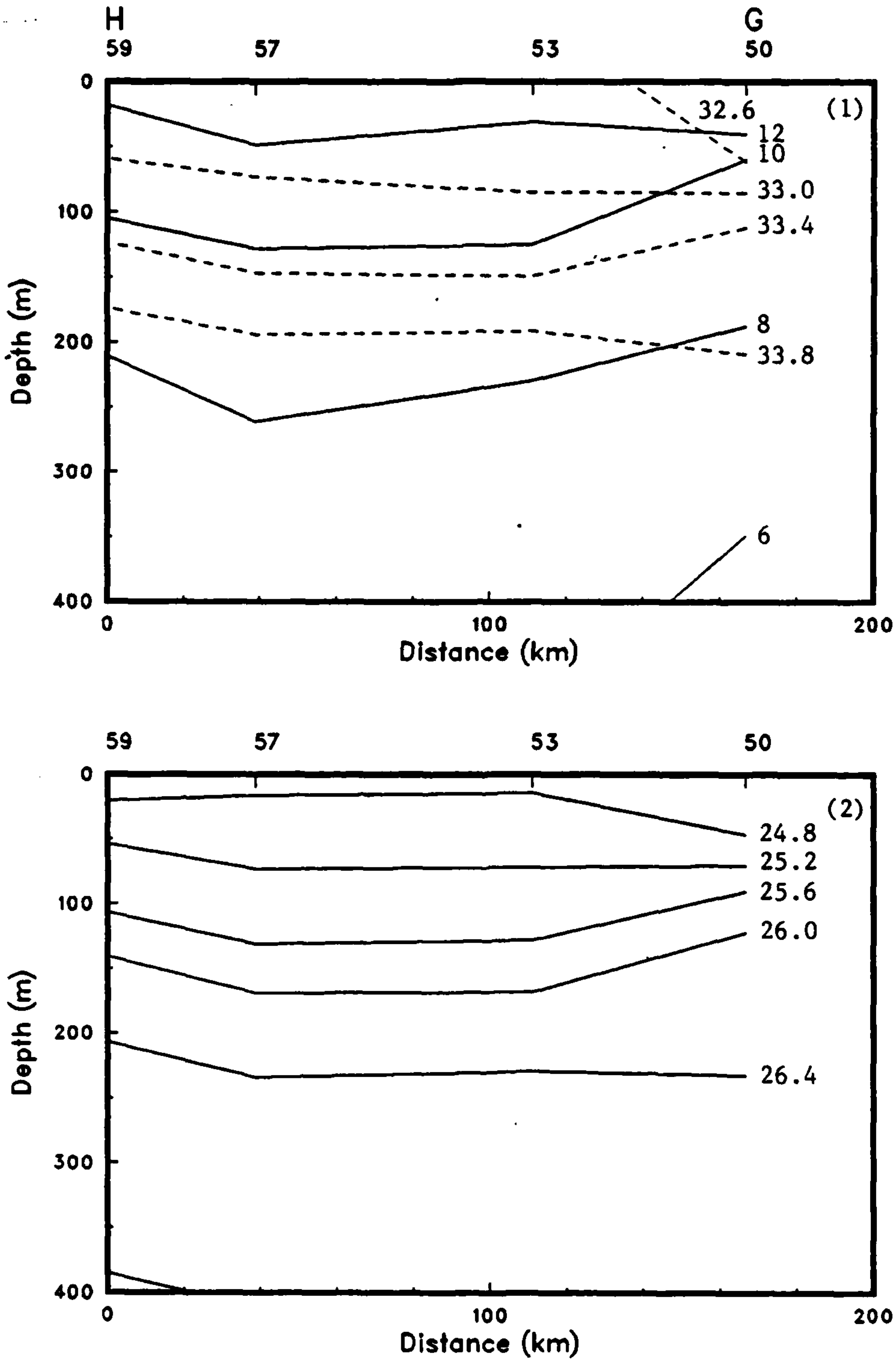

H
G
59
57
53
50
(1)
32.6
12
10
33.0
33.4
8
33.8
6
Depth (m)
Distance (km)
0
100
200
300
400
0
100
200
59
57
53
50
(2)
24.8
25.2
25.6
26.0
26.4
Depth (m)
Distance (km)

Figure 8(b)

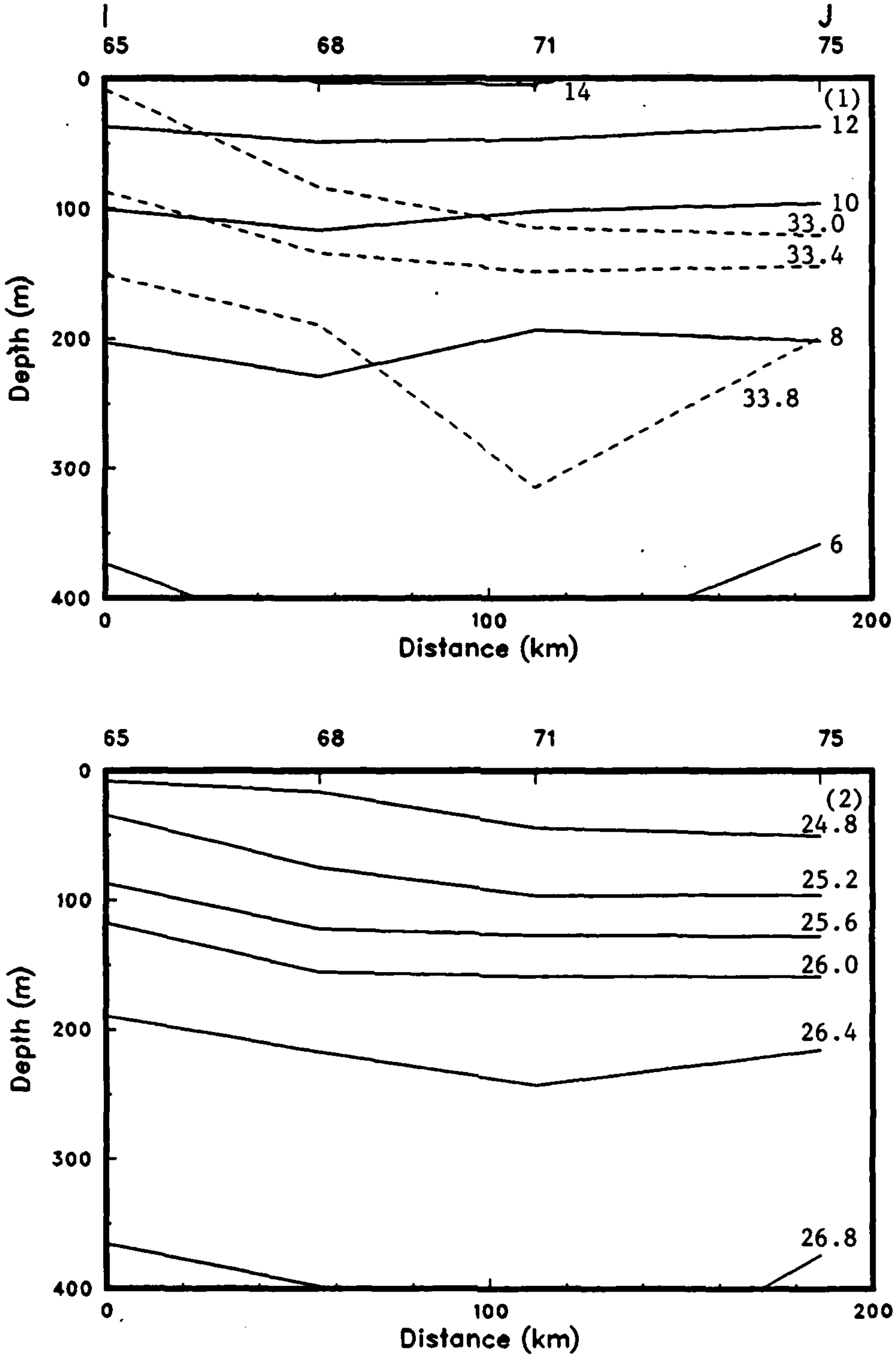
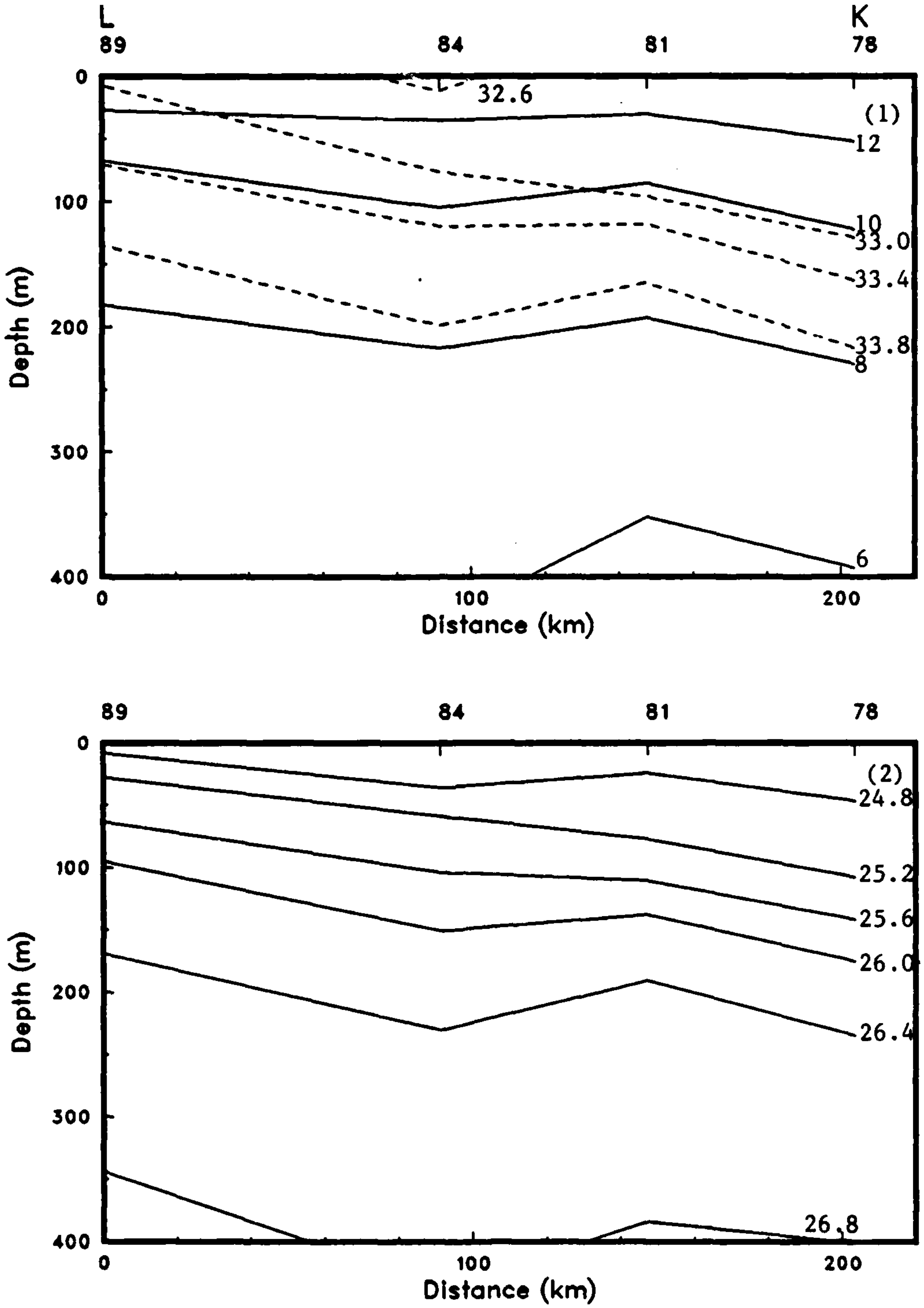
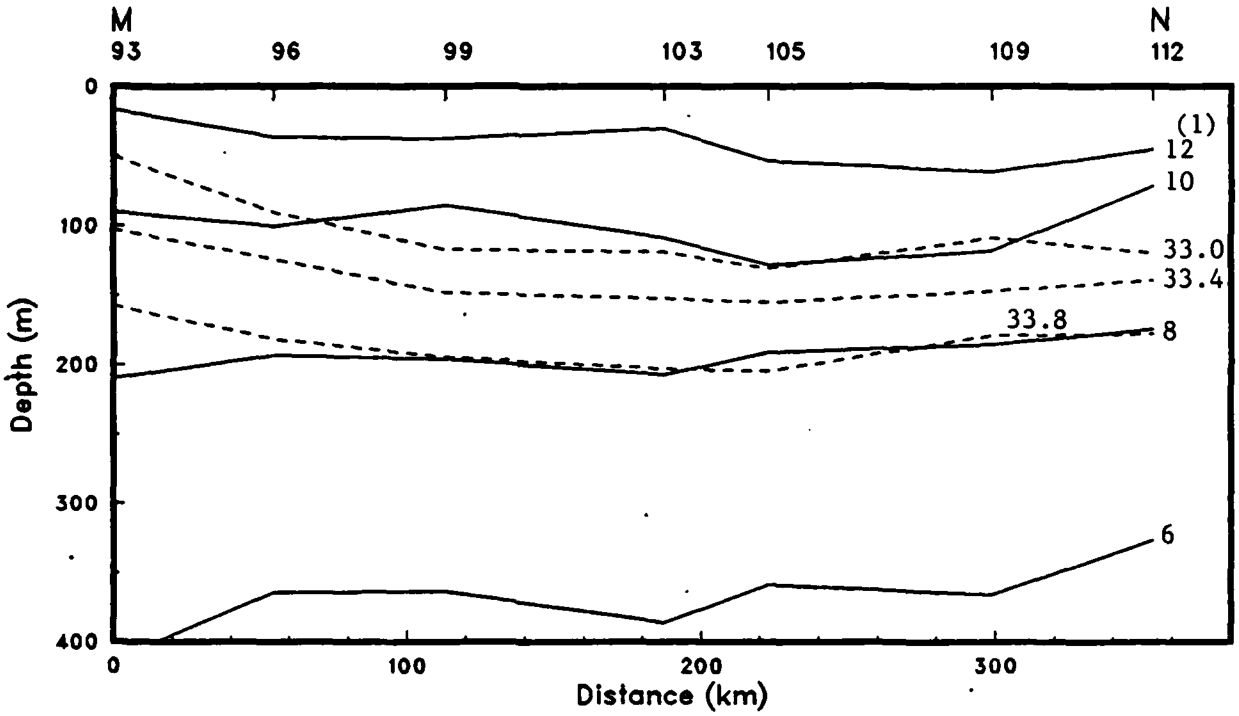

I
J
65
68
71
75
14
(1)
12
10
33.0
33.4
8
33.8
6
Depth (m)
Distance (km)
0
100
200
300
400
0
100
200
65
68
71
75
(2)
24.8
25.2
25.6
26.0
26.4
26.8
Depth (m)
Distance (km)

Figure 8(c)

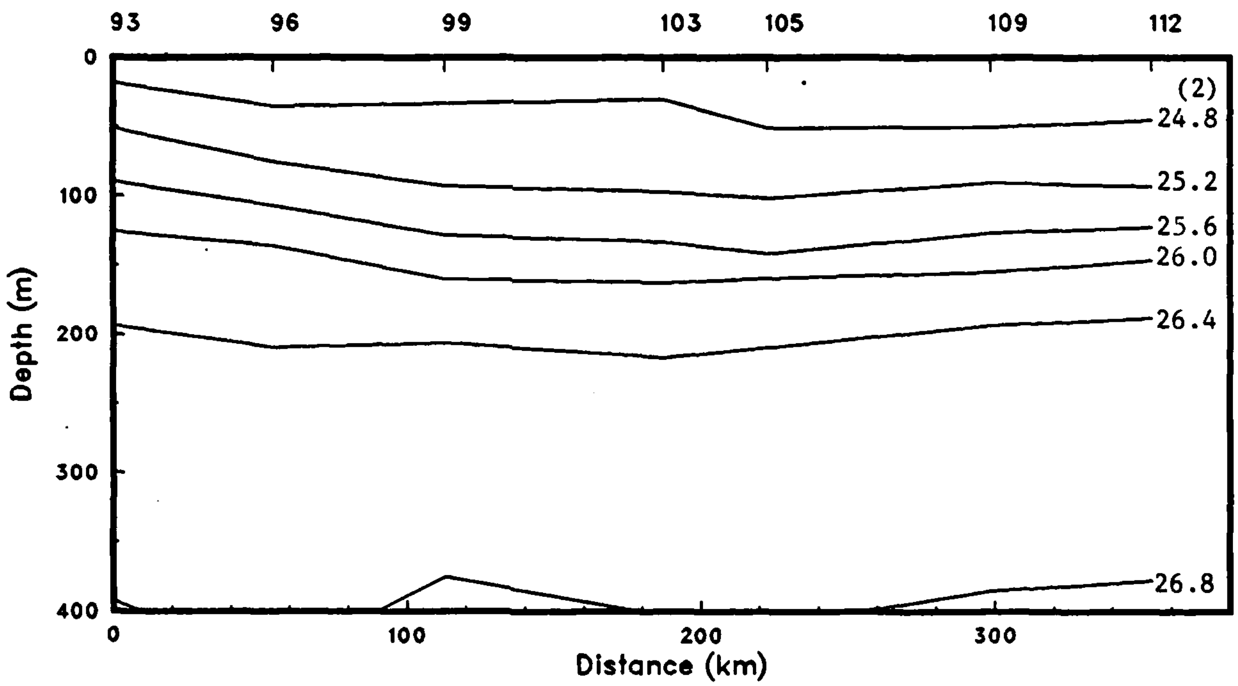


L
K
89
84
81
78
32.6
(1)
12
10
33.0
33.4
33.8
8
6
Depth (m)
Distance (km)
89
84
81
78
(2)
24.8
25.2
25.6
26.0
26.4
26.8
Depth (m)
Distance (km)

Figure 8(d)



M
N
93
96
99
103
105
109
112
(1)
12
10
33.0
33.4
33.8
8
6
Depth (m)
Distance (km)
0
100
200
300
400



93
96
99
103
105
109
112
(2)
24.8
25.2
25.6
26.0
26.4
26.8
Depth (m)
Distance (km)
0
100
200
300
400

Figure 8(e)

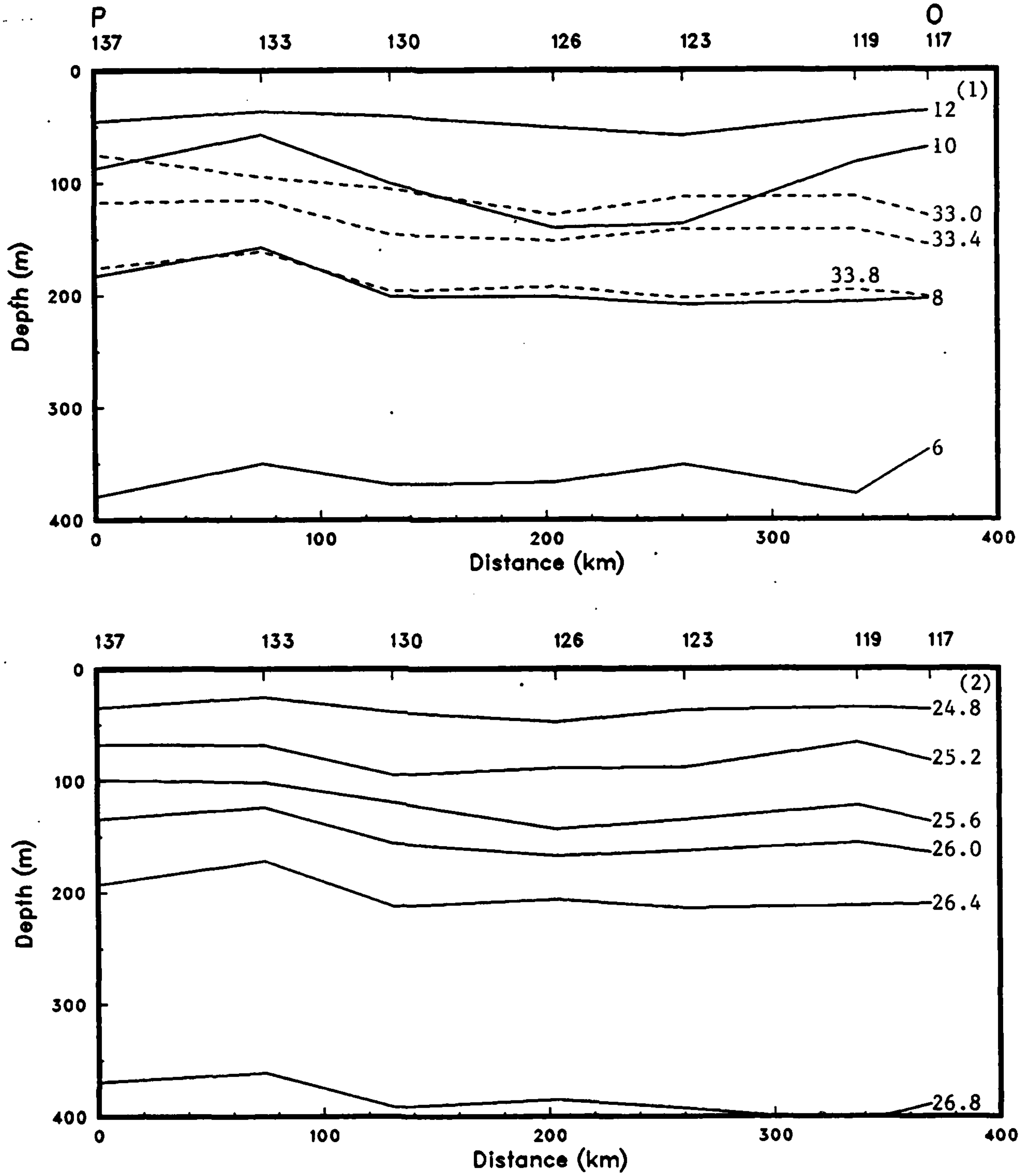

P
O
137
133
130
126
123
119
117
(1)
12
10
33.0
33.4
33.8
8
6
Depth (m)
Distance (km)
(2)
24.8
25.2
25.6
26.0
26.4
26.8

Figure 8(f)

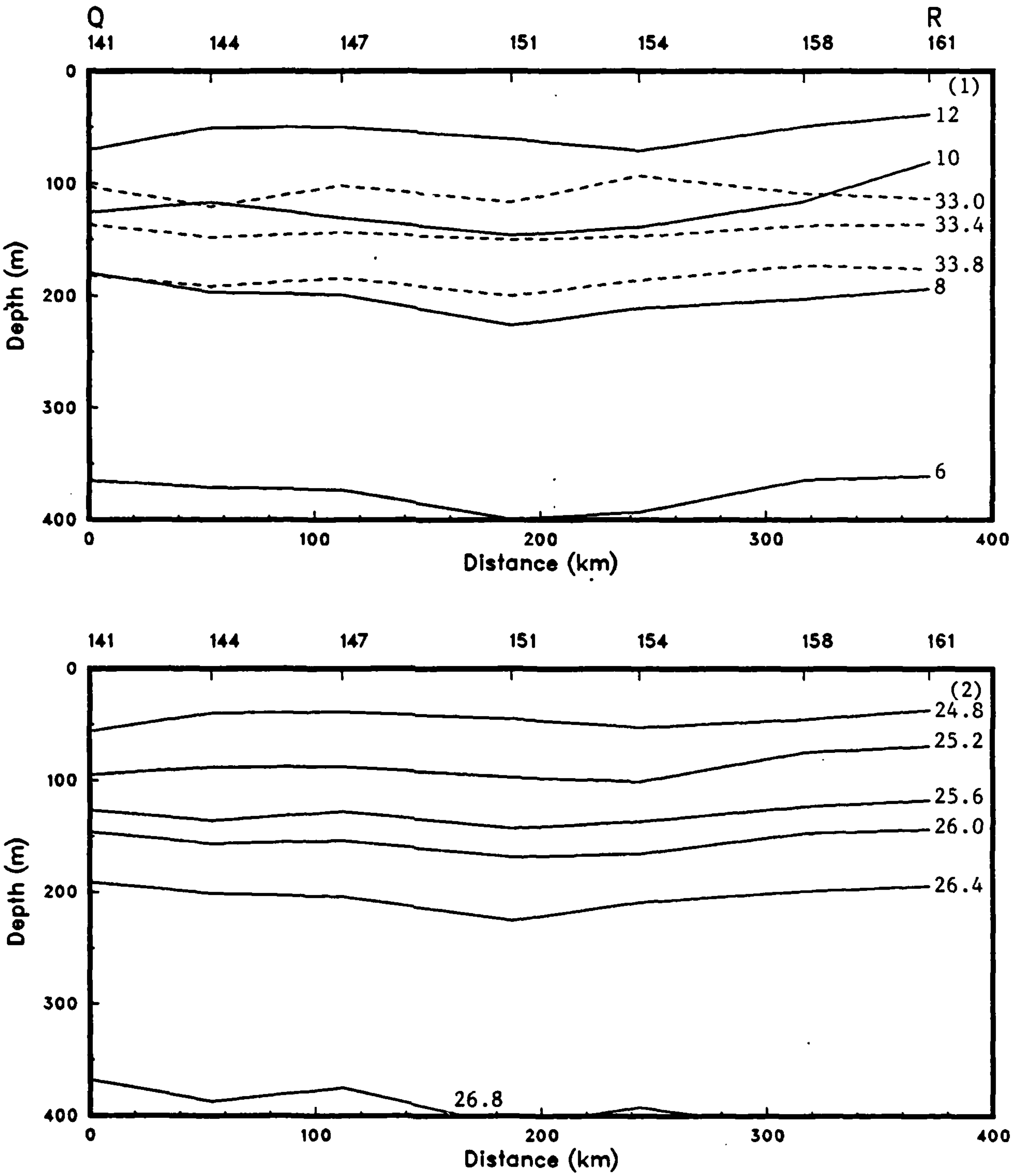
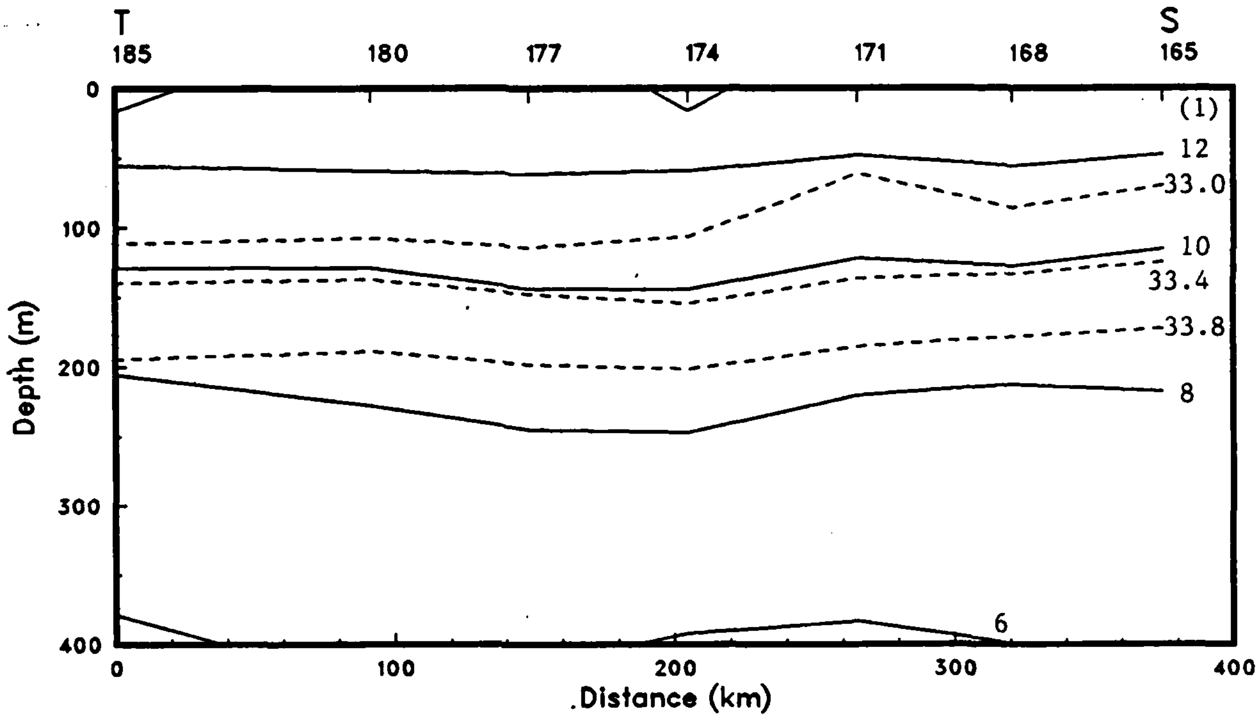
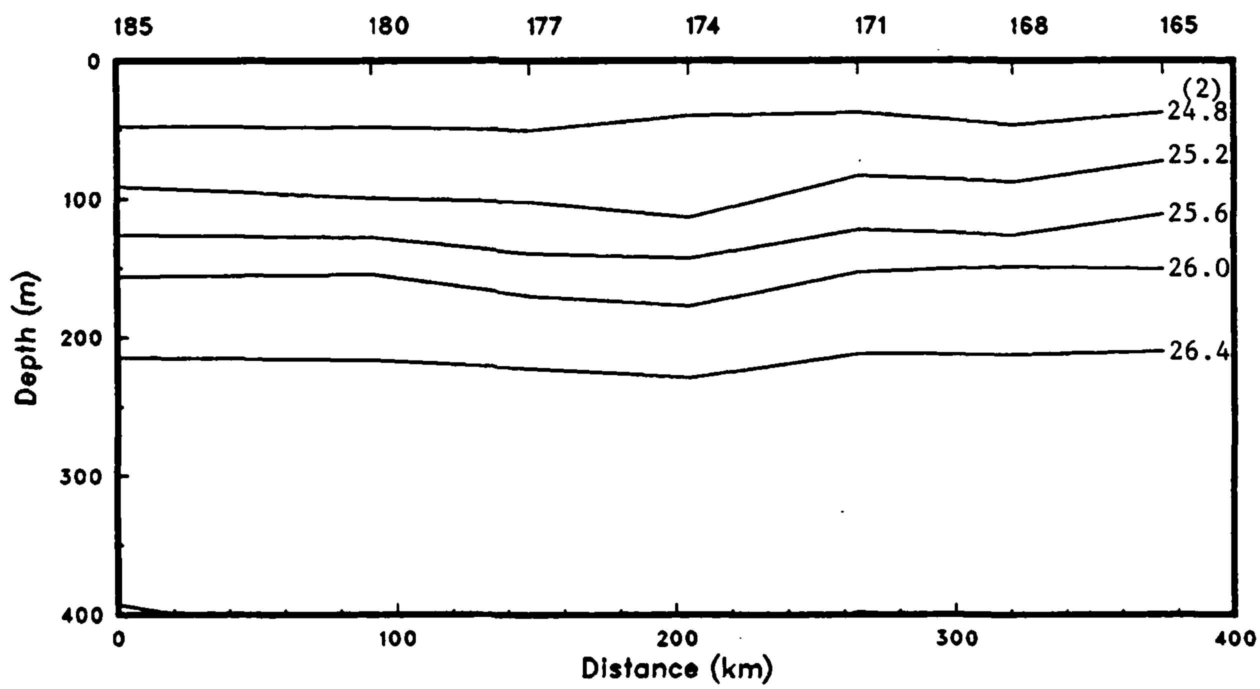

Q
R
141
144
147
151
154
158
161
(1)
12
10
33.0
33.4
33.8
8
6
Depth (m)
Distance (km)
(2)
24.8
25.2
25.6
26.0
26.4
26.8
Depth (m)
Distance (km)

Figure 8(g)

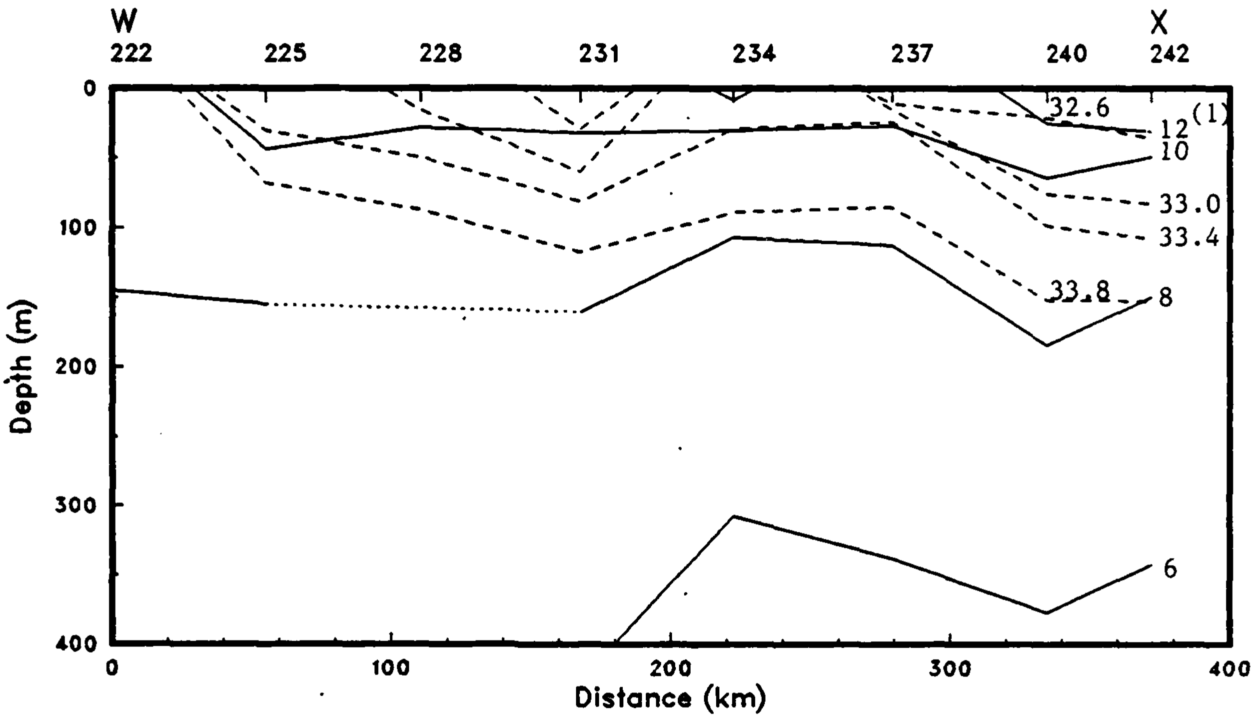


T
S
185
180
177
174
171
168
165
(1)
12
33.0
10
33.4
33.8
8
6
Depth (m)
Distance (km)



185
180
177
174
171
168
165
(2)
24.8
25.2
25.6
26.0
26.4
Depth (m)
Distance (km)

Figure 8(h)


W
X
222
225
228
231
234
237
240
242
32.6
12
(1)
10
33.0
33.4
33.8
8
6
0
100
200
300
400
Depth (m)
Distance (km)

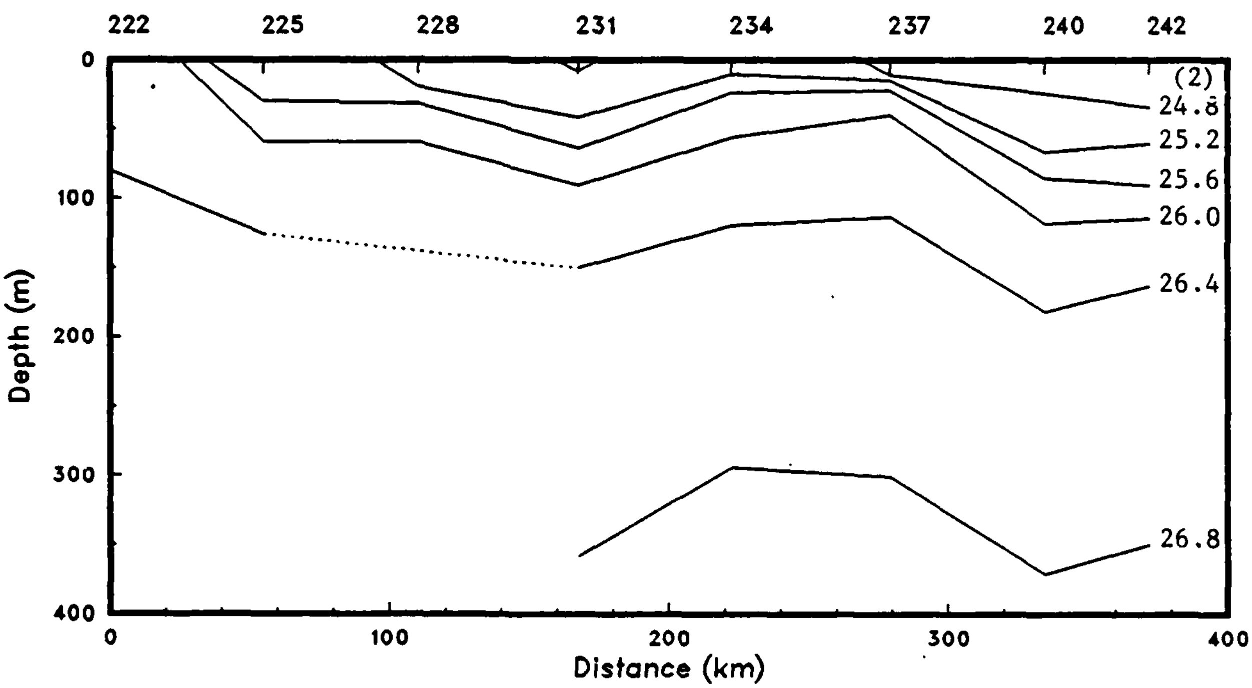
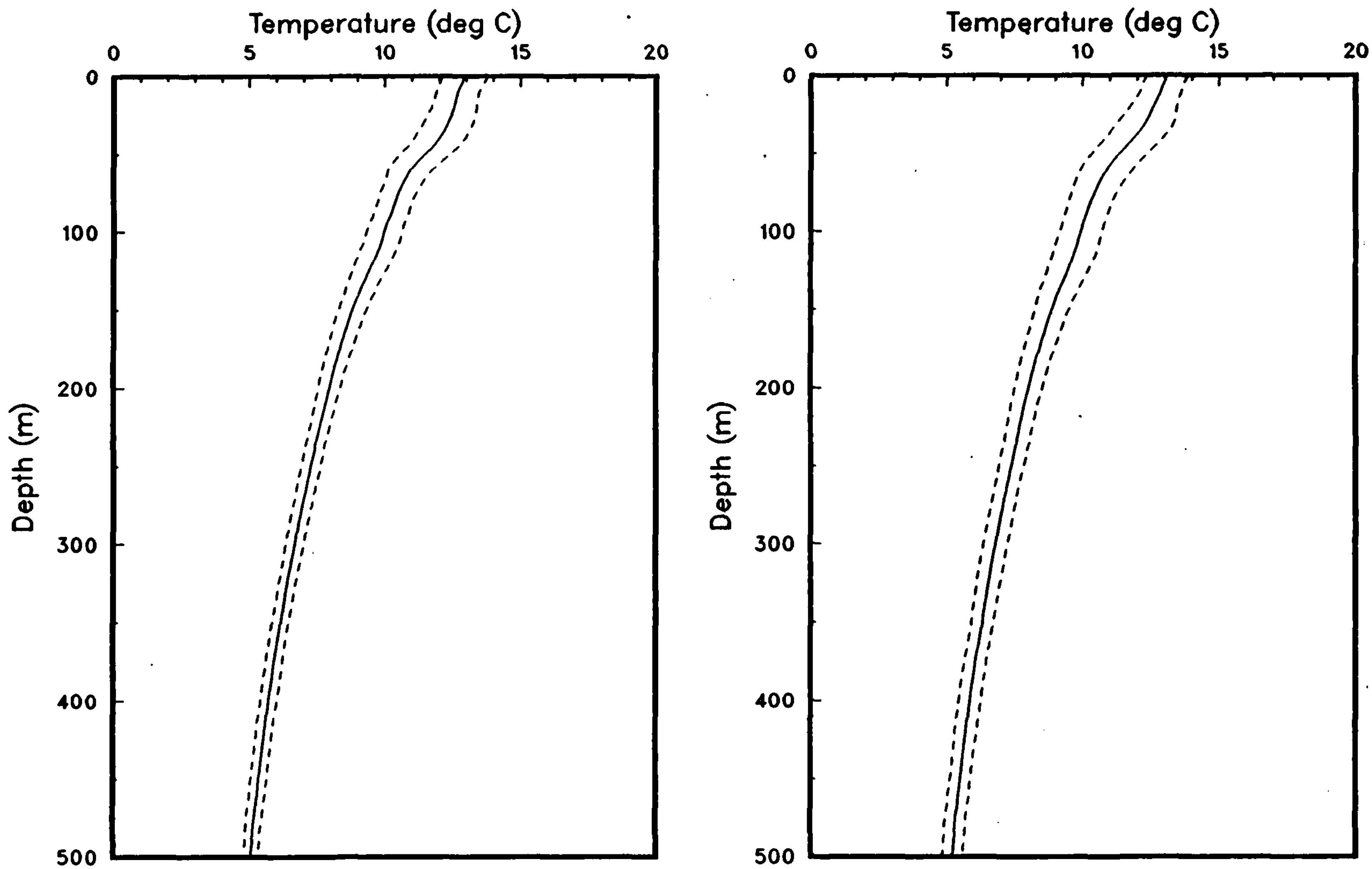

222
225
228
231
234
237
240
242
(2)
24.8
25.2
25.6
26.0
26.4
26.8
0
100
200
300
400
Depth (m)
Distance (km)

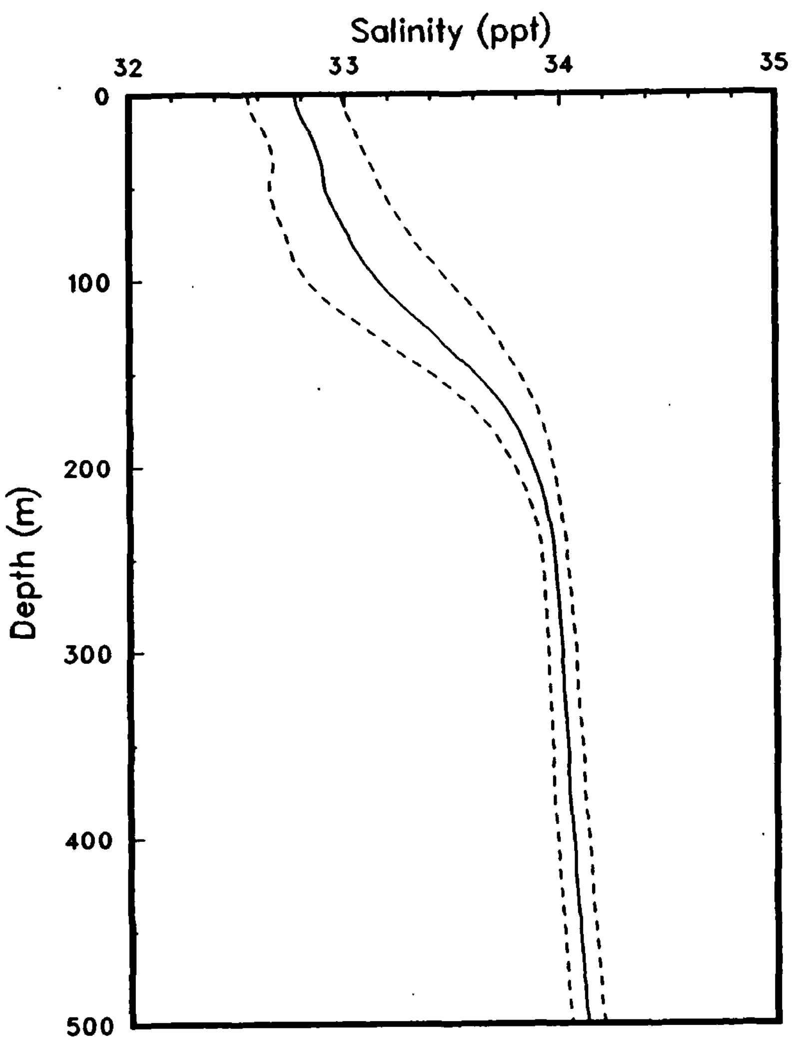
Figure 8(i)



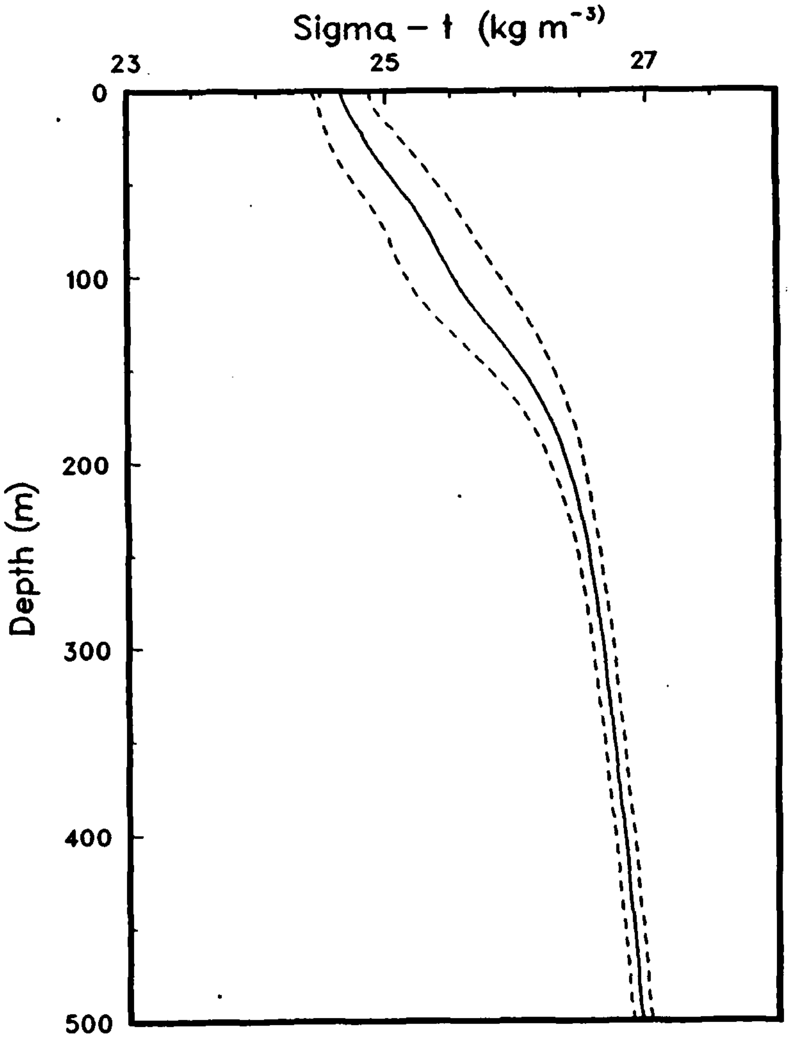
(a)

(b)

Figure 9: Mean temperature profiles from (a) XBT's and (b) CTD's, with + and - the standard deviation (OPTOMA16, Leg MI).



(a)



(b)

Figure 10: Mean profiles of (a) salinity and (b) sigma-t, with + and - the standard deviations, from the CTD's (OPTOMA16, Leg MI).

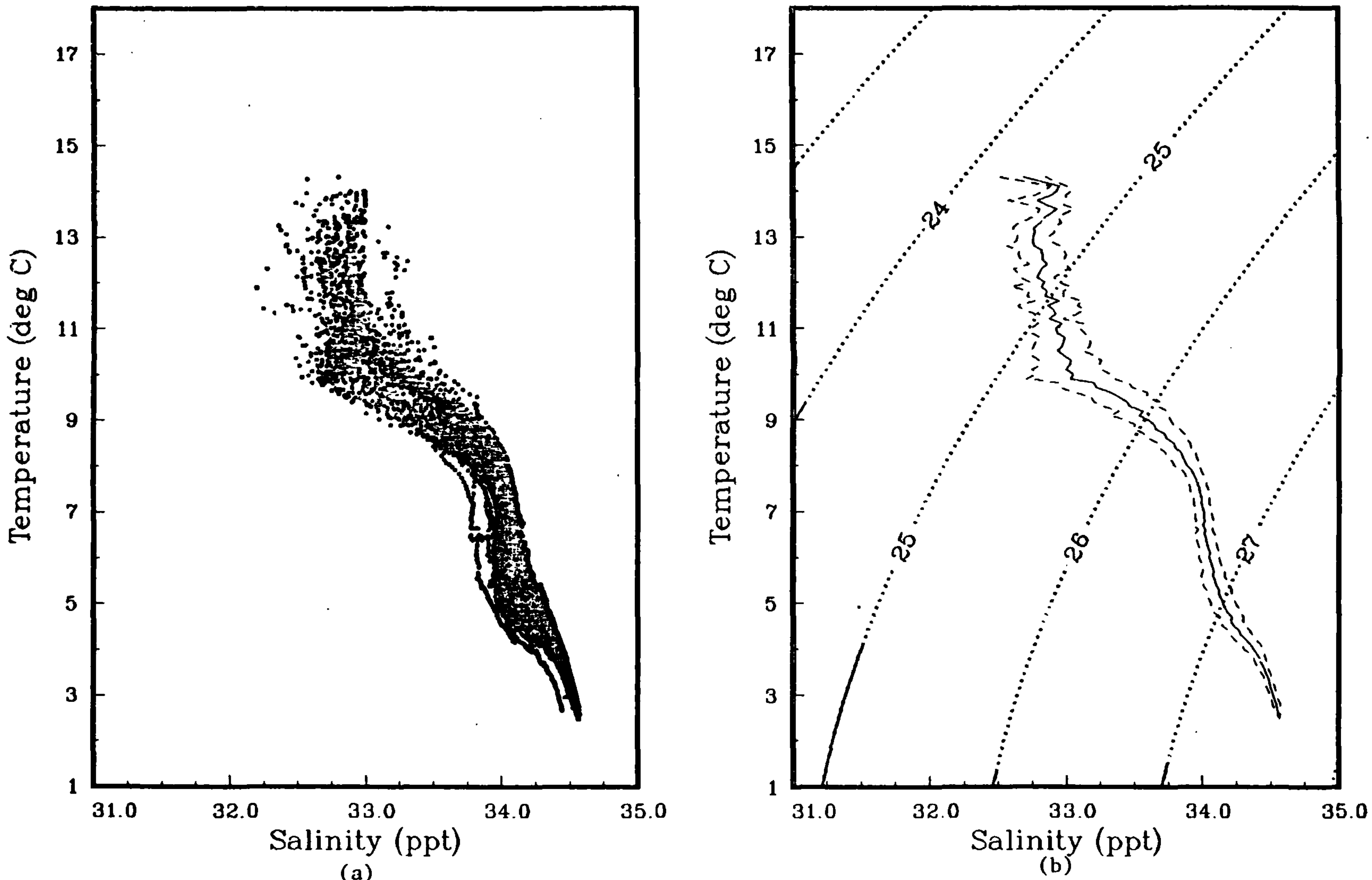


Figure 11: (a) T-S pairs and (b) mean T-S relation, with + and - the standard deviation, from the CTD's. Selected sigma-t contours are also shown (OPTOMA16, Leg MI).

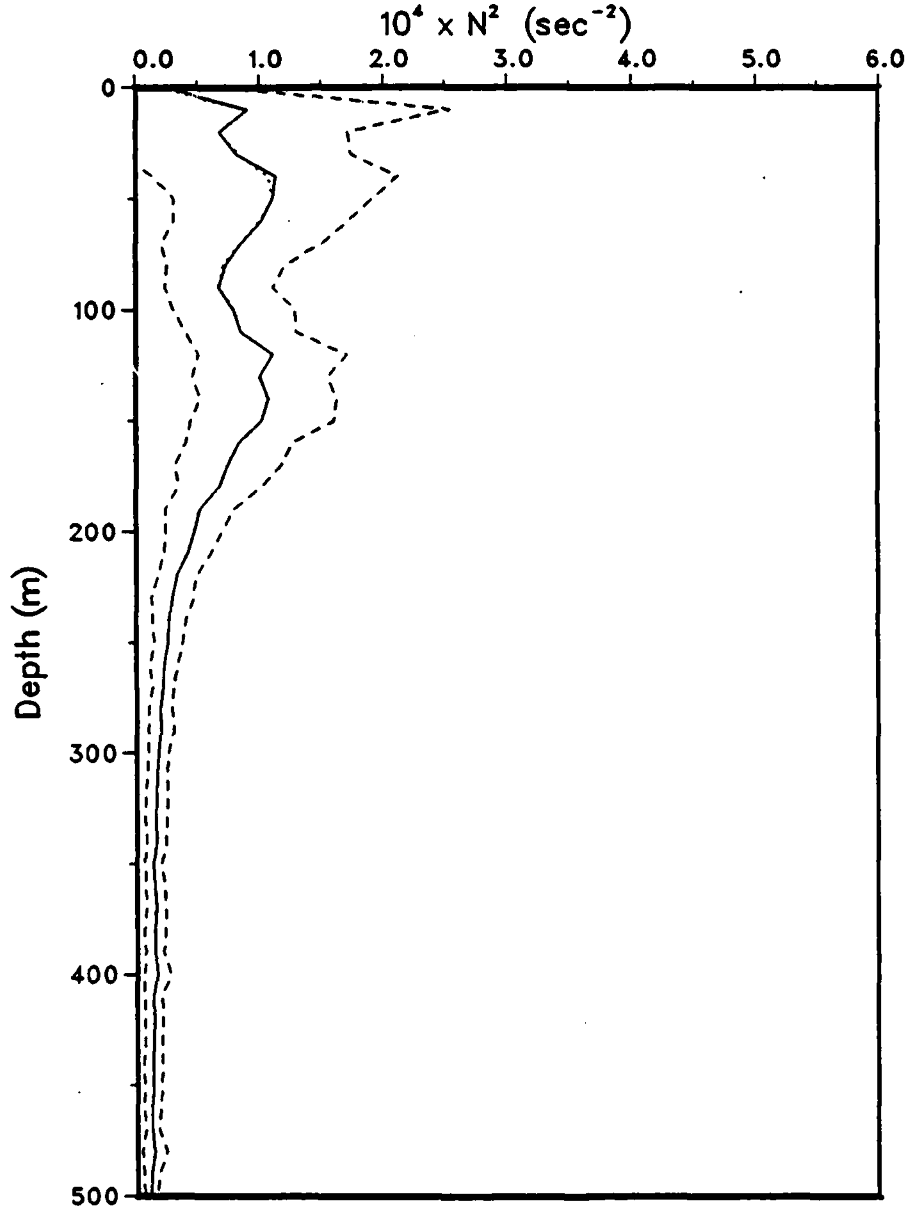


Figure 12: Mean N^2 profile (——), with + and - the standard deviation (---). The N^2 profile from $\overline{T(z)}$ and $\overline{S(z)}$ is also shown (...) (OPTOMA16, Leg MI).

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SECTION 1

OPTOMA16 LEG MII

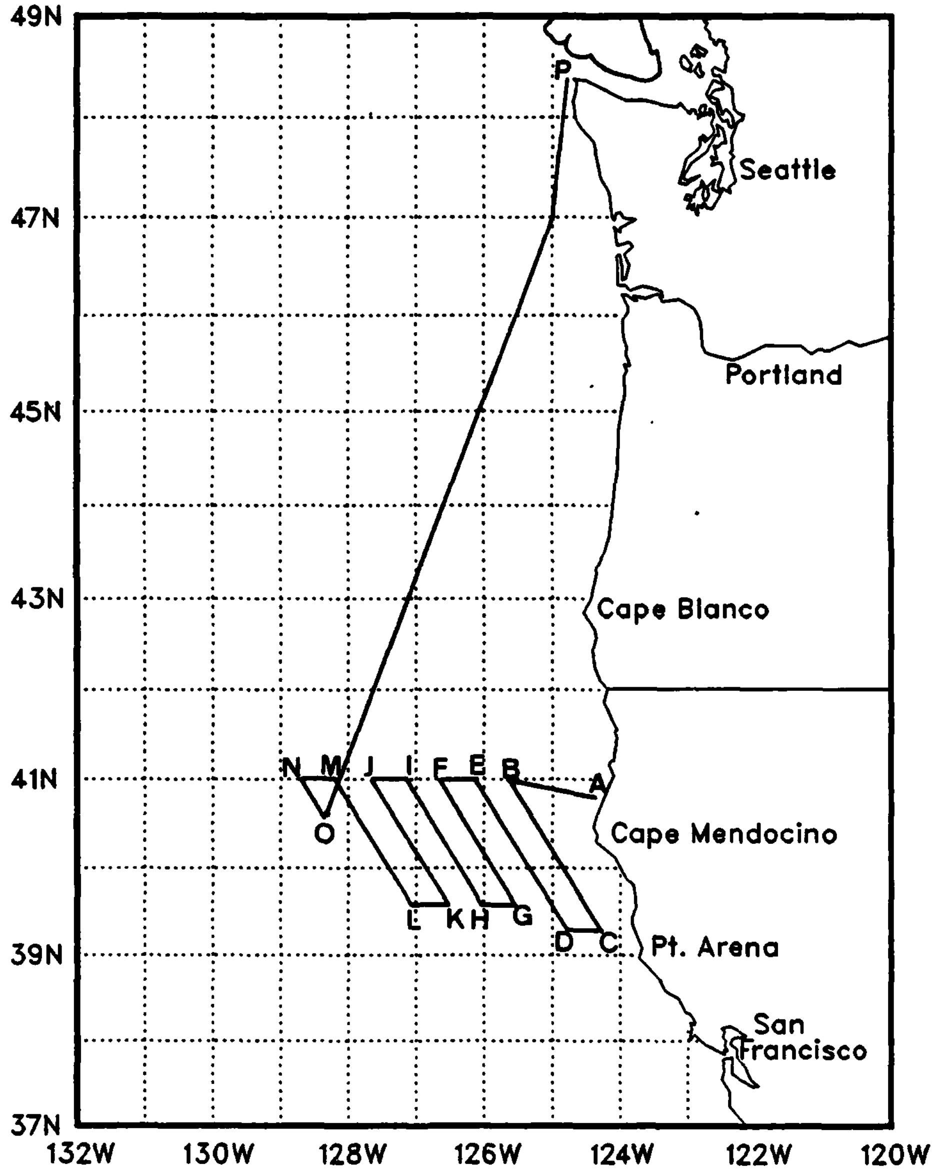


Figure 13: The cruise track for OPTOMA16, Leg MII.

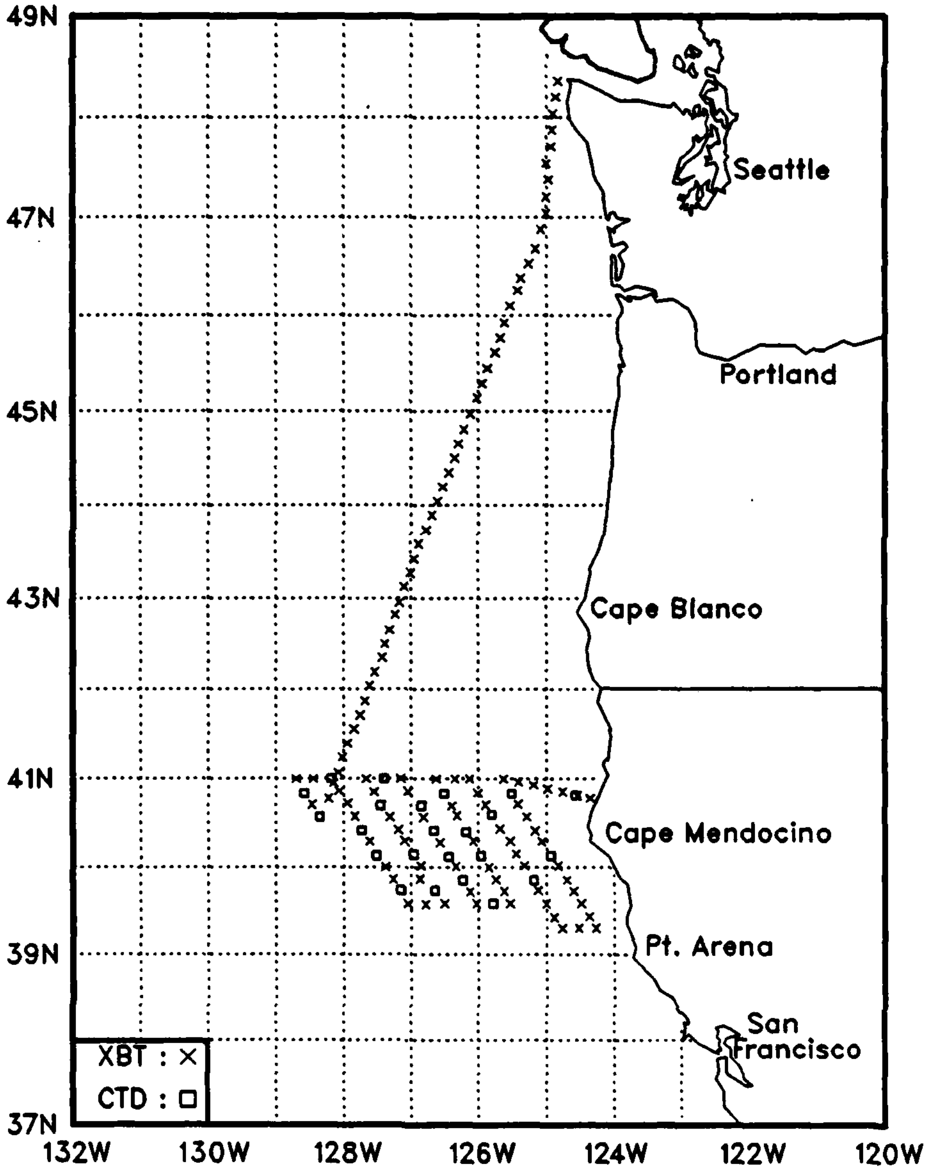


Figure 14: XBT and CTD locations for OPTOMA16, Leg MII.

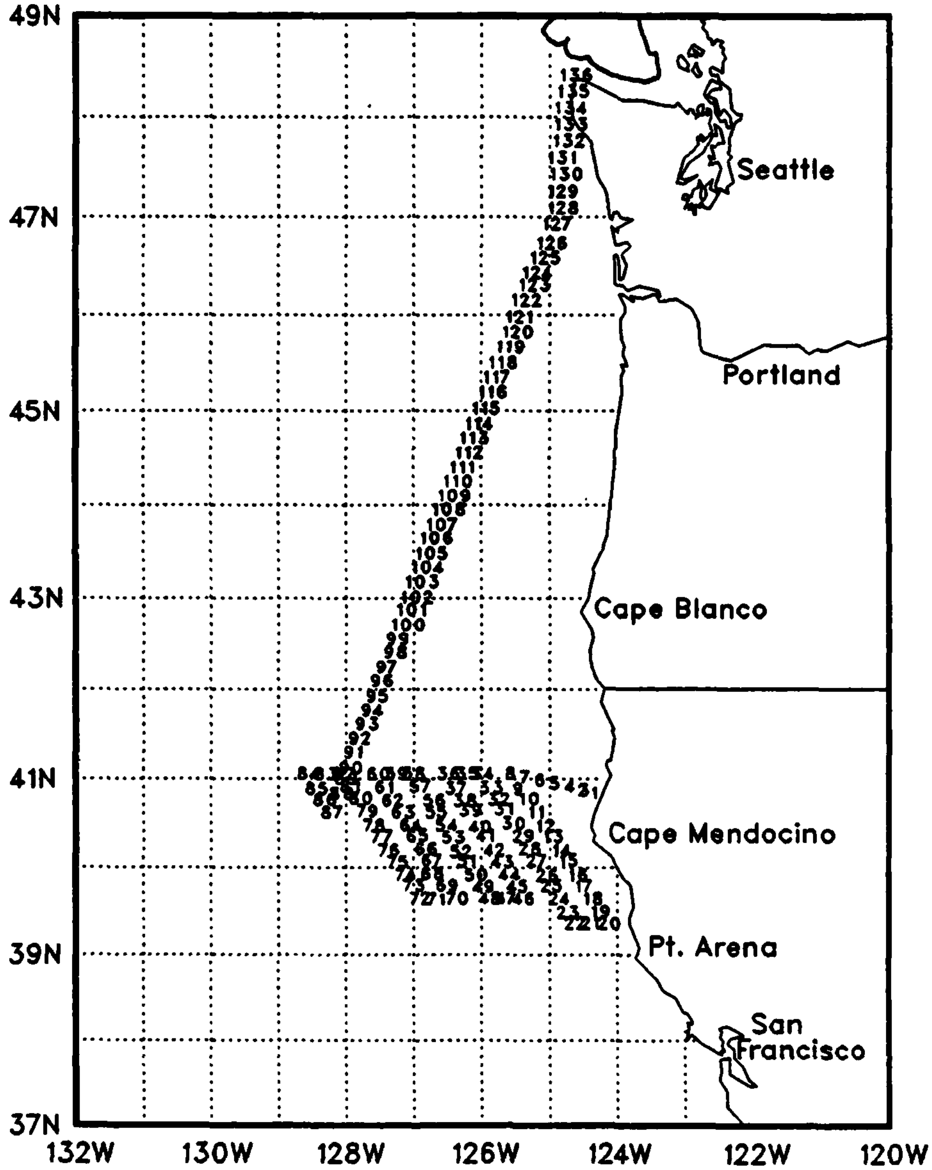


Figure 15: Station numbers for OPTOMA16, Leg MII.

Table 4 : Leg MII Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	85155	2201	40.47	124.21	11.6			
2	CTD	85155	2300	40.49	124.34	12.9	31.47	12.3	32.04
3	XBT	85155	2315	40.49	124.32	12.0			
4	XBT	85156	28	40.51	124.45	13.2			
5	XBT	85156	121	40.53	124.59	13.9			
6	XBT	85156	210	40.56	125.11	13.4			
7	XBT	85156	258	40.58	125.25	13.6			
8	XBT	85156	348	41.00	125.38	13.1			
9	CTD	85156	457	40.50	125.31	13.3	32.45	13.4	32.47
10	XBT	85156	612	40.43	125.25	13.4			
11	XBT	85156	701	40.34	125.17	13.8			
12	XBT	85156	758	40.25	125.10	13.1			
13	XBT	85156	847	40.17	125.04	11.9			
14	CTD	85156	952	40.08	124.56	13.3	33.07	13.3	33.07
15	XBT	85156	1051	40.01	124.49	14.1			
16	XBT	85156	1138	39.51	124.41	13.1			
17	XBT	85156	1225	39.43	124.35	13.7			
18	XBT	85156	1312	39.35	124.28	13.7			
19	XBT	85156	1359	39.26	124.21	14.1			
20	XBT	85156	1447	39.18	124.16	13.7			
21	XBT	85156	1546	39.18	124.31	14.1			
22	XBT	85156	1649	39.18	124.46	14.2			
23	XBT	85156	1738	39.25	124.53	14.2			
24	XBT	85156	1828	39.35	125.00	14.1			
25	XBT	85156	1916	39.44	125.07	14.4			
26	CTD	85156	2050	39.51	125.11	13.1	32.14	13.3	32.19
27	XBT	85156	2234	40.01	125.19	13.6			
28	XBT	85156	2327	40.09	125.27	13.7			
29	XBT	85157	19	40.18	125.32	13.2			
30	XBT	85157	106	40.26	125.41	14.2			
31	CTD	85157	227	40.36	125.48	13.9	32.45	14.1	32.47
32	XBT	85157	336	40.42	125.53	13.6			
33	XBT	85157	424	40.50	126.01	13.4			
34	XBT	85157	512	41.00	126.08	13.2			
35	XBT	85157	607	41.00	126.21	13.3			
36	XBT	85157	711	41.00	126.38	13.4			
37	CTD	85157	859	40.50	126.31	13.2	32.63	13.4	32.63
38	XBT	85157	1011	40.42	126.24	13.0			
39	XBT	85157	1057	40.35	126.19	12.9			
40	CTD	85157	1221	40.24	126.11	13.3	32.26	13.5	32.25
41	XBT	85157	1335	40.18	126.04	13.2			
42	CTD	85157	1451	40.08	125.58	13.8	32.42	13.9	32.41
43	XBT	85157	1558	40.00	125.51	13.7			
44	XBT	85157	1646	39.51	125.44	13.6			
45	XBT	85157	1733	39.43	125.37	13.4			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
46	XBT	85157	1820	39.35	125.32	13.7			
47	CTD	85157	1936	39.35	125.47	14.2	32.55	14.4	32.54
48	XBT	85157	2054	39.35	126.02	13.9			
49	XBT	85157	2139	39.43	126.07	14.0			
50	CTD	85157	2255	39.51	126.14	13.7	32.60	13.9	32.57
51	XBT	84158	30	40.01	126.20	13.4			
52	CTD	85158	125	40.07	126.27	14.0	32.68	14.2	32.64
53	XBT	85158	245	40.17	126.34	13.8			
54	CTD	85158	356	40.25	126.40	13.9	32.57	14.1	32.56
55	XBT	85158	524	40.34	126.49	13.0			
56	CTD	85158	628	40.42	126.51	13.7	32.26	13.9	32.64
57	XBT	85158	804	40.51	127.03	13.0			
58	XBT	85158	854	41.00	127.09	13.2			
59	CTD	85158	1017	41.00	127.24	13.4	32.64	13.8	32.63
60	XBT	85158	1153	41.00	127.40	13.1			
61	XBT	85158	1251	40.51	127.33	12.8			
62	CTD	85158	1409	40.42	127.27	13.5	32.24	13.8	32.23
63	XBT	85158	1527	40.34	127.18	13.2			
64	XBT	85158	1615	40.25	127.11	13.5			
65	XBT	85158	1705	40.18	127.05	14.2			
66	CTD	85158	1819	40.09	126.58	14.0	32.72	14.2	32.71
67	XBT	85158	1938	40.01	126.52	14.0			
68	XBT	85158	2026	39.52	126.44	13.7			
69	CTD	85158	2141	39.44	126.39	14.5	32.69	14.8	32.70
70	XBT	85158	2301	39.35	126.30	14.1			
71	XBT	85159	17	39.34	126.47	14.1			
72	XBT	85159	109	39.35	127.03	14.6			
73	CTD	85159	222	39.44	127.09	14.6	32.85	14.9	32.84
74	XBT	85159	348	39.51	127.15	14.0			
75	XBT	85159	439	40.00	127.23	13.9			
76	CTD	85159	606	40.08	127.31	13.8	32.68	14.0	32.68
77	XBT	85159	728	40.18	127.37	13.4			
78	CTD	85159	834	40.25	127.44	13.5	32.43	13.8	32.58
79	XBT	85159	943	40.35	127.50	13.4			
80	XBT	85159	1031	40.43	127.56	13.3			
81	XBT	85159	1120	40.51	128.04	13.5			
82	CTD	85159	1234	41.00	128.11	13.5	32.63	13.9	32.61
83	XBT	85159	1402	41.00	128.27	13.4			
84	XBT	85159	1459	41.00	128.42	13.4			
85	CTD	85159	1628	40.50	128.35	13.5	32.70	13.7	32.69
86	XBT	85159	1801	40.42	128.28	13.4			
87	CTD	85159	1919	40.34	128.21	13.6	32.71	13.9	32.69
88	XBT	85159	2145	40.47	128.13	13.9			
89	XBT	85159	2239	40.57	128.09	13.5			
90	XBT	85159	2335	41.04	128.05	13.6			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
91	XBT	85160	32	41.14	128.01	13.4			
92	XBT	85160	129	41.24	127.57	13.0			
93	XBT	85160	225	41.33	127.51	13.1			
94	XBT	85160	323	41.42	127.45	13.1			
95	XBT	85160	423	41.52	127.41	13.0			
96	XBT	85160	523	42.02	127.37	12.9			
97	XBT	85160	625	42.11	127.32	13.0			
98	XBT	85160	723	42.21	127.25	13.0			
99	XBT	85160	821	42.30	127.23	13.1			
100	XBT	85160	924	42.39	127.18	13.2			
101	XBT	85160	1025	42.49	127.13	13.1			
102	XBT	85160	1126	42.57	127.10	12.9			
103	XBT	85160	1230	43.07	127.06	12.9			
104	XBT	85160	1335	43.16	127.00	12.9			
105	XBT	85160	1444	43.26	126.57	13.0			
106	XBT	85160	1549	43.35	126.53	12.9			
107	XBT	85160	1655	43.44	126.47	12.9			
108	XBT	85160	1759	43.54	126.42	12.7			
109	XBT	85160	1904	44.03	126.37	12.9			
110	XBT	85160	2007	44.12	126.32	12.6			
111	XBT	85160	2115	44.21	126.26	12.8			
112	XBT	85160	2216	44.30	126.21	13.2			
113	XBT	85160	2317	44.40	126.18	14.0			
114	XBT	85161	13	44.49	126.13	13.8			
115	XBT	85161	103	44.58	126.07	13.9			
116	XBT	85161	154	45.09	126.01	13.4			
117	XBT	85161	245	45.18	125.57	13.5			
118	XBT	85161	336	45.27	125.52	13.4			
119	XBT	85161	427	45.37	125.45	13.1			
120	XBT	85161	517	45.46	125.40	13.4			
121	XBT	85161	607	45.56	125.37	13.3			
122	XBT	85161	705	46.06	125.32	13.1			
123	XBT	85161	745	46.15	125.25	13.1			
124	XBT	85161	834	46.23	125.22	13.0			
125	XBT	85161	922	46.32	125.15	13.0			
126	XBT	85161	1012	46.41	125.10	13.0			
127	XBT	85161	1115	46.53	125.05	13.1			
128	XBT	85161	1202	47.02	125.00	13.7			
129	XBT	85161	1256	47.13	125.00	13.8			
130	XBT	85161	1343	47.23	124.58	13.2			
131	XBT	85161	1435	47.33	125.00	13.2			
132	XBT	85161	1531	47.43	124.55	13.9			
133	XBT	85161	1624	47.53	124.54	13.0			
134	XBT	85161	1717	48.03	124.54	13.2			
135	XBT	85161	1800	48.12	124.51	12.5			
136	XBT	85161	1855	48.22	124.49	11.0			

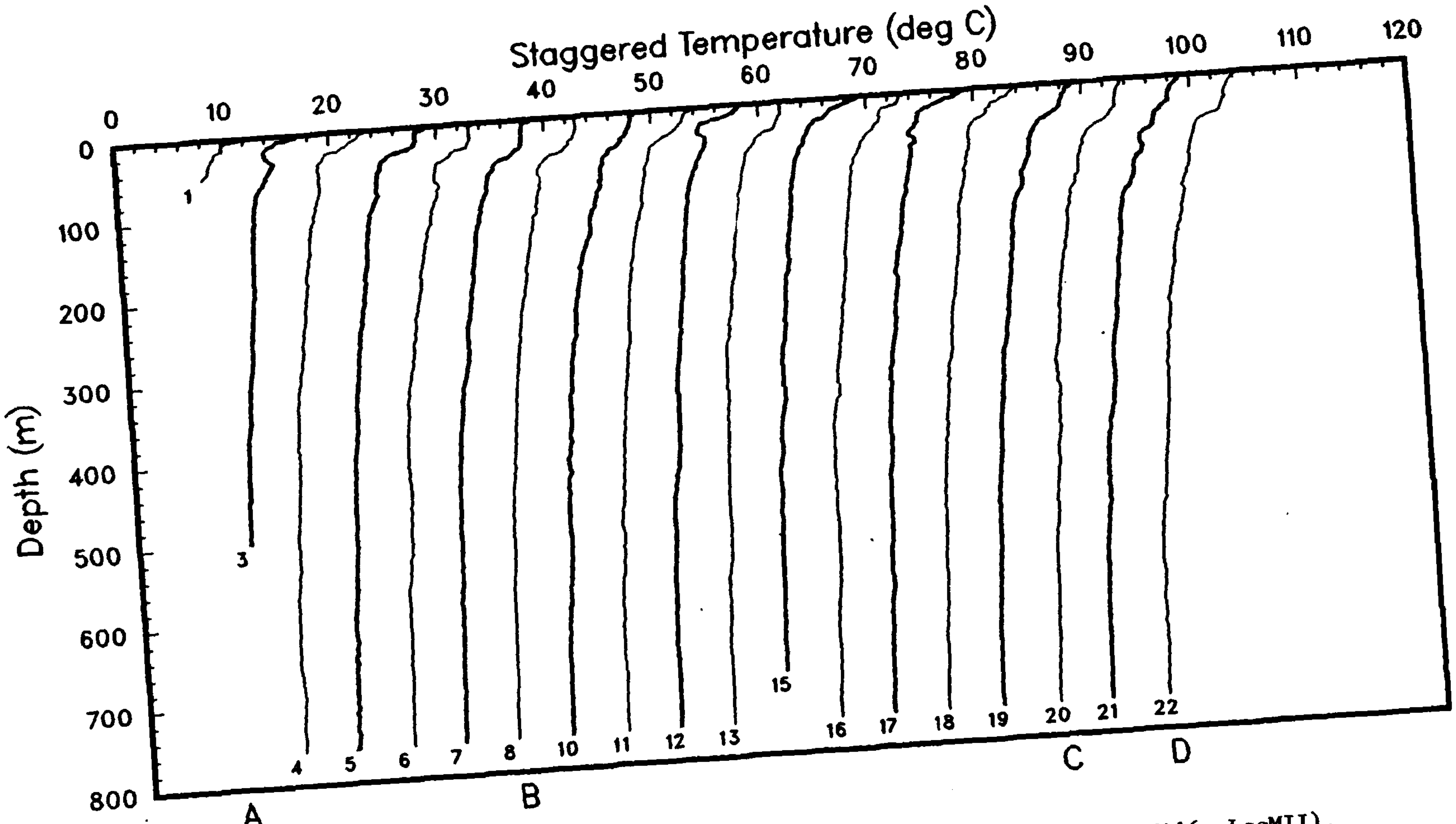


Figure 16(a): XBT temperature profiles, staggered by multiples of 5C (OPTOMA16, LegMII).

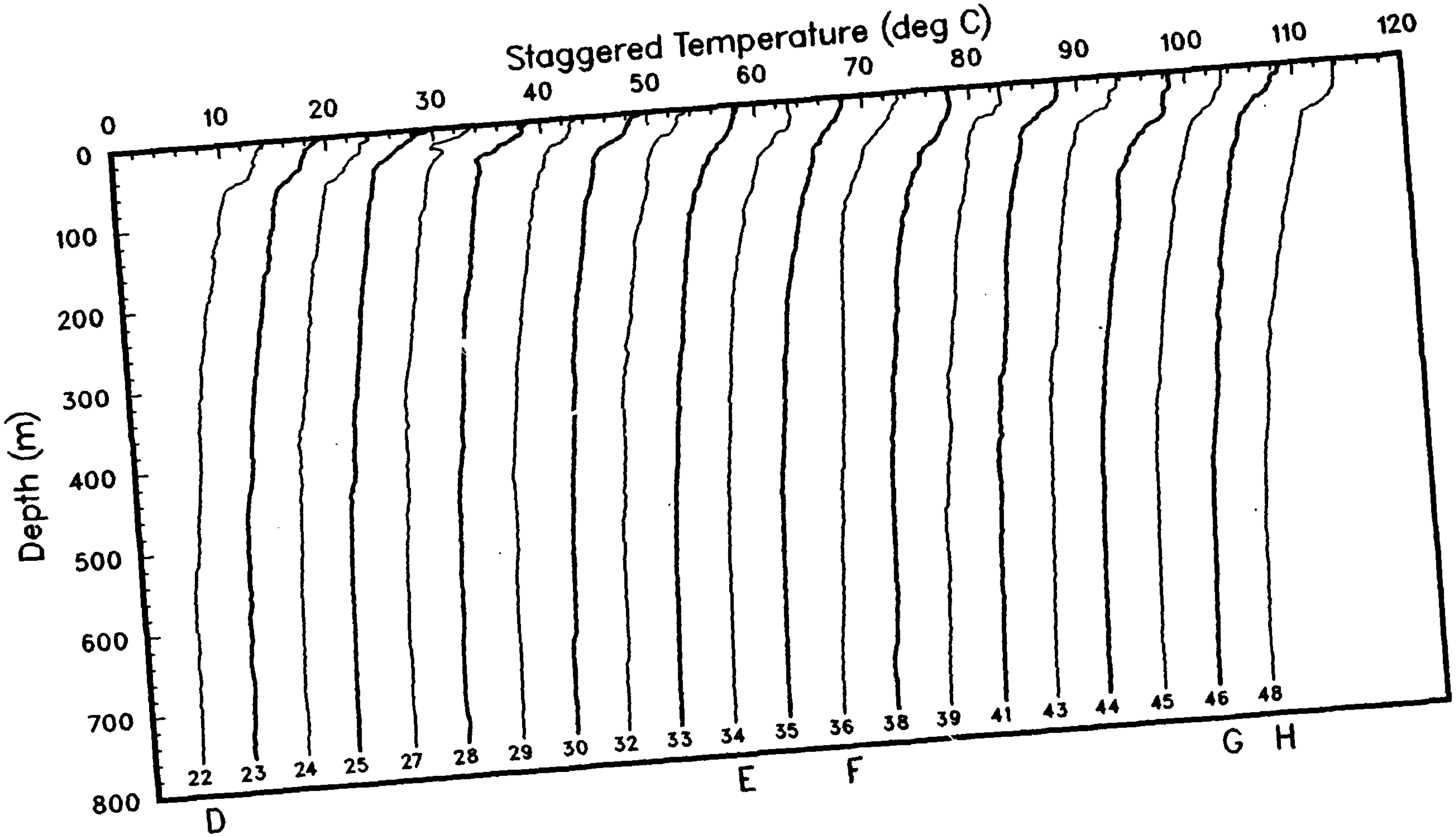

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
22 23 24 25 27 28 29 30 32 33 34 35 36 38 39 41 43 44 45 46 48
D
E
F
G
H

Figure 16(b)

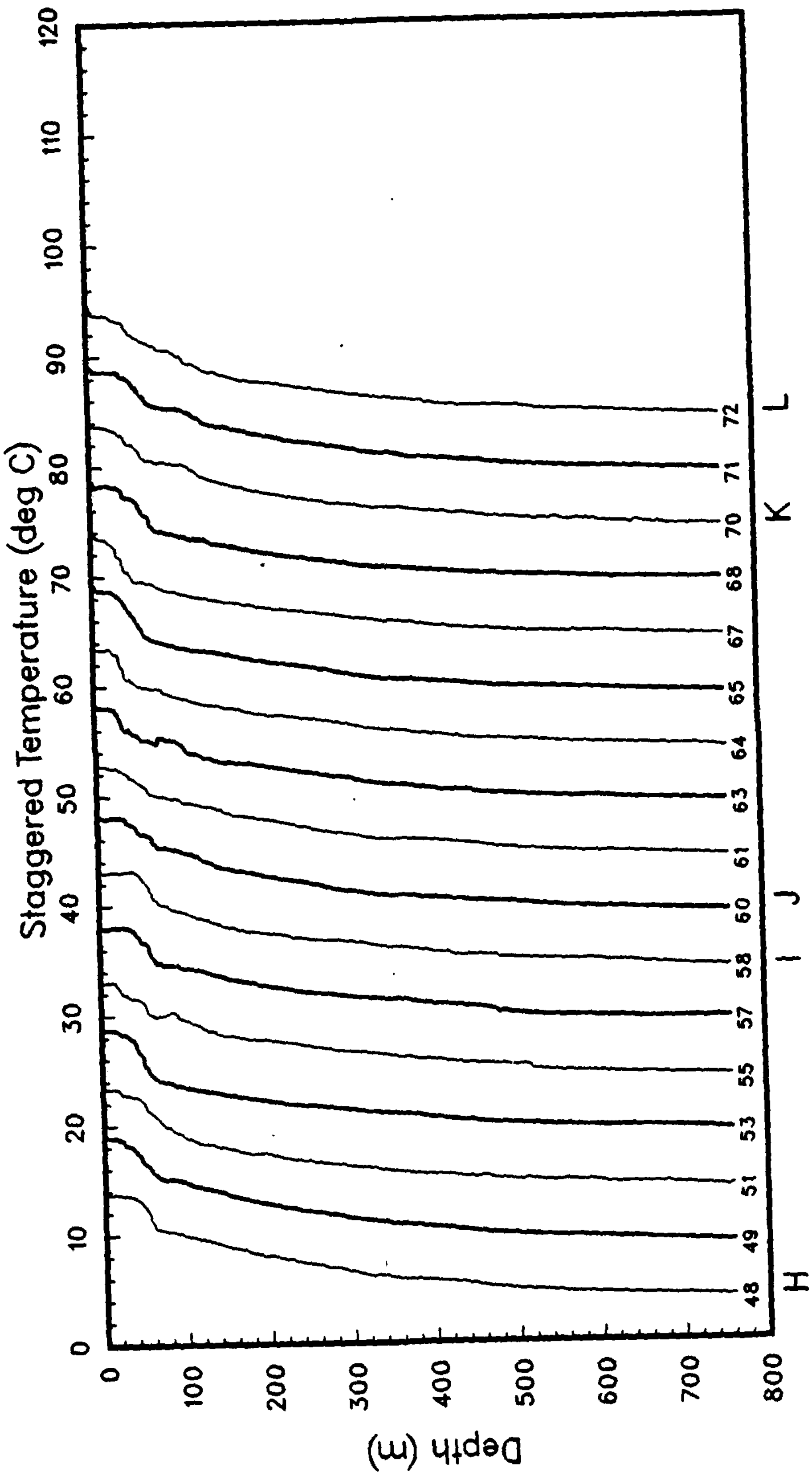

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
48
49
51
53
55
57
58
60
61
63
64
65
67
68
70
71
72
H
I
J
K
L

Figure 16(c)

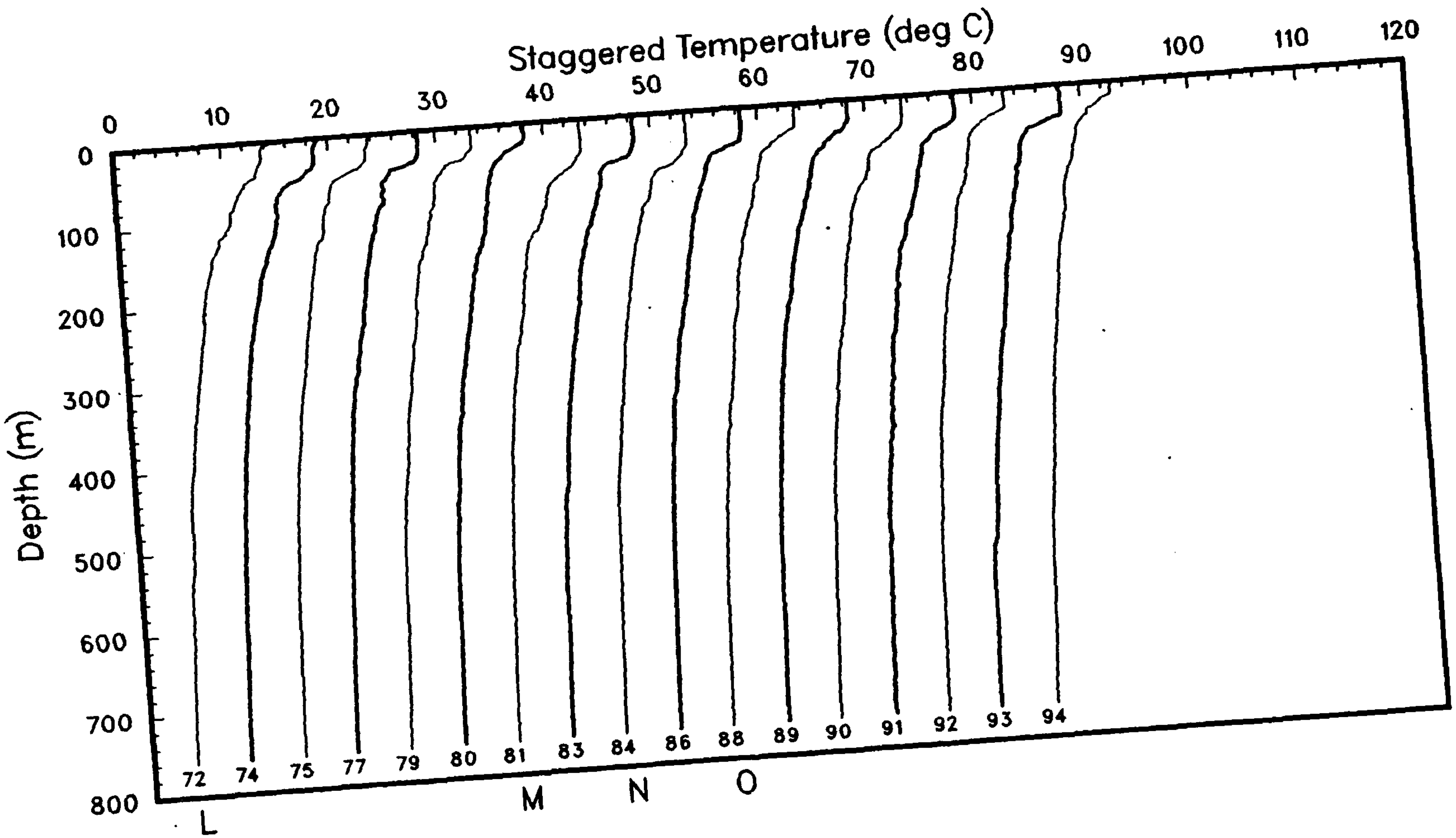
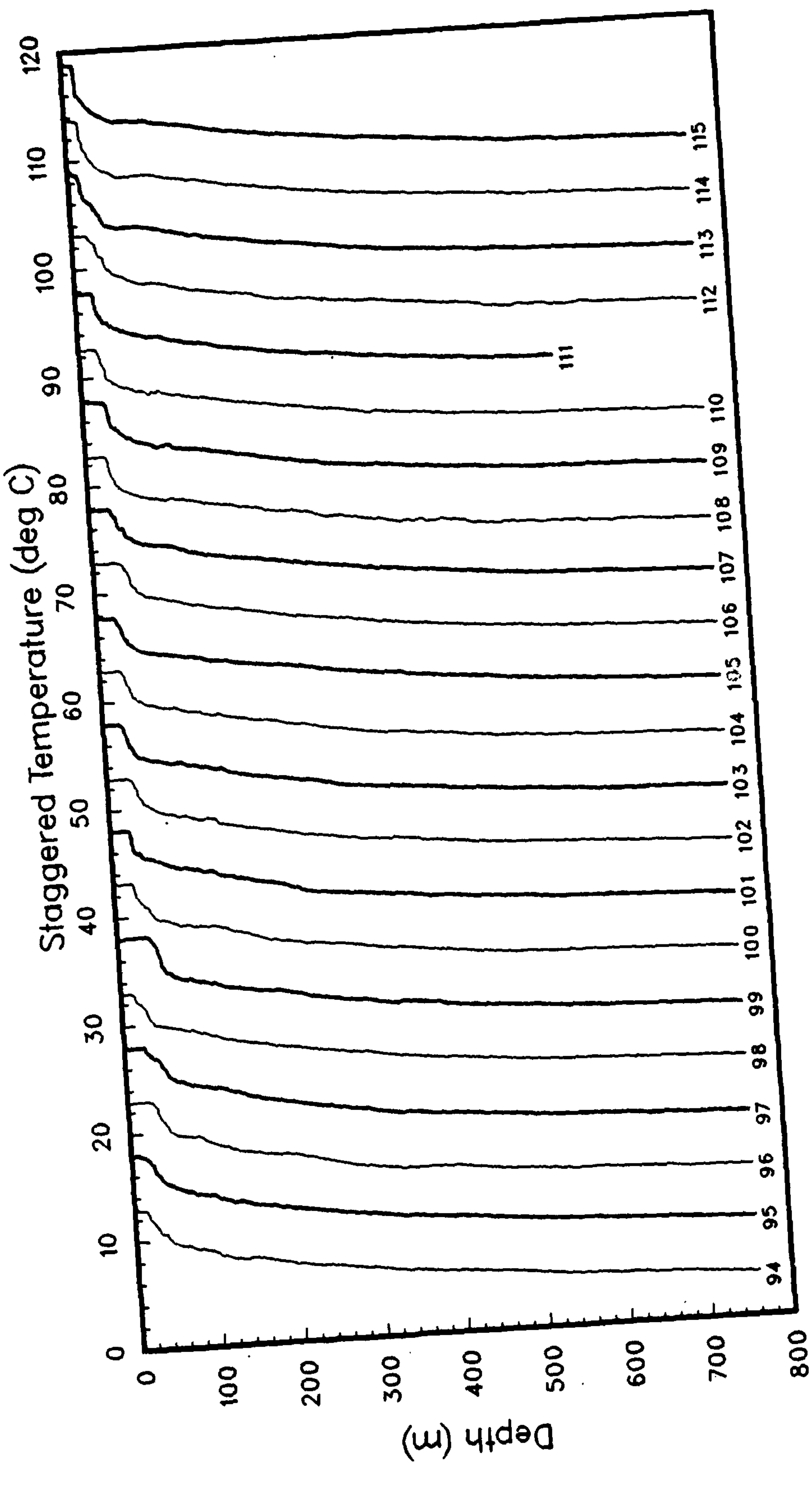

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
72
74
75
77
79
80
81
83
84
86
88
89
90
91
92
93
94
L
M
N
O

Figure 16(d)



Staggered Temperature (deg C)
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
0
100
200
300
400
500
600
700
800
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115

Figure 16(e)

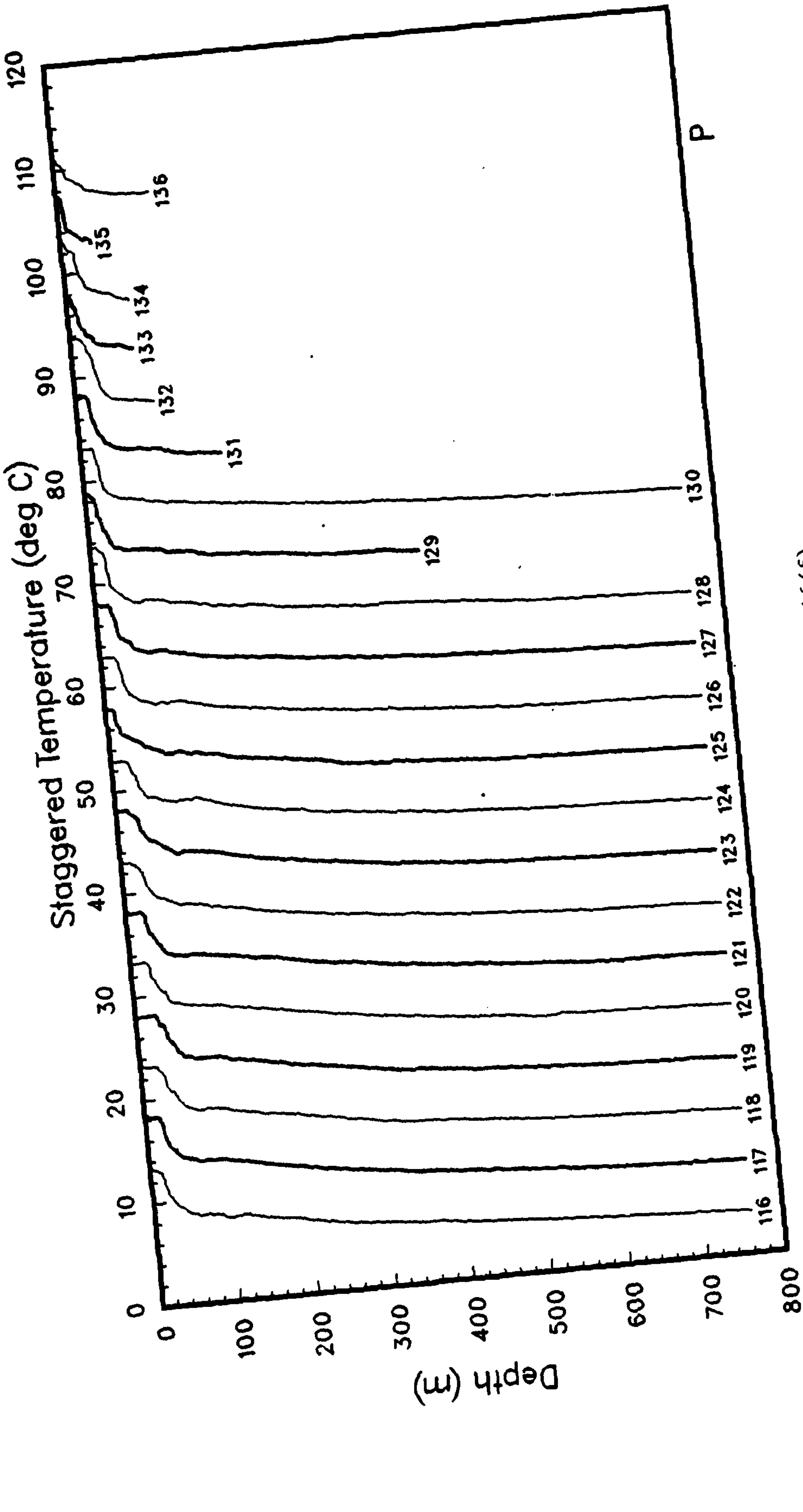

Staggered Temperature (deg C)
Depth (m)
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136

Figure 16(f)

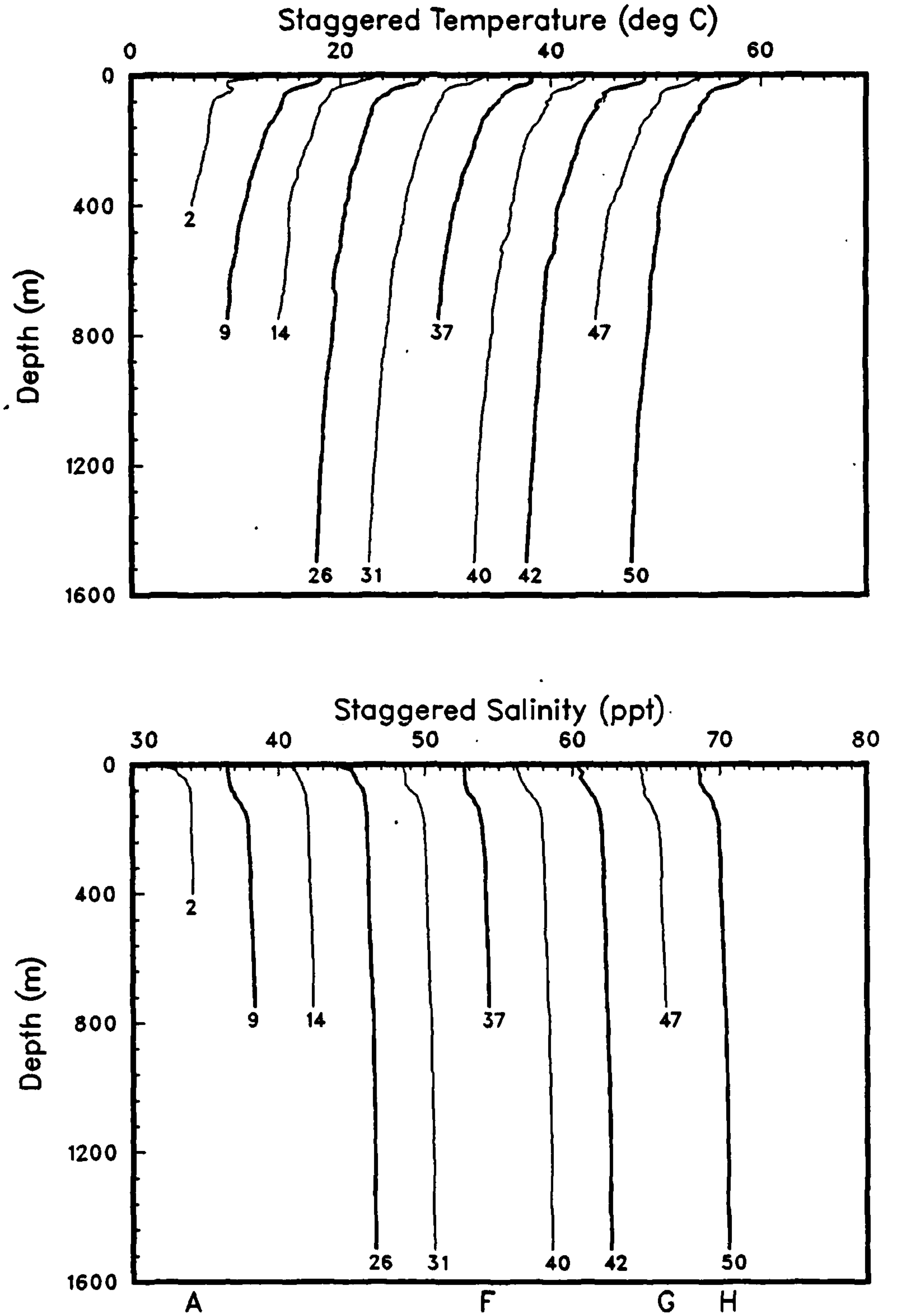
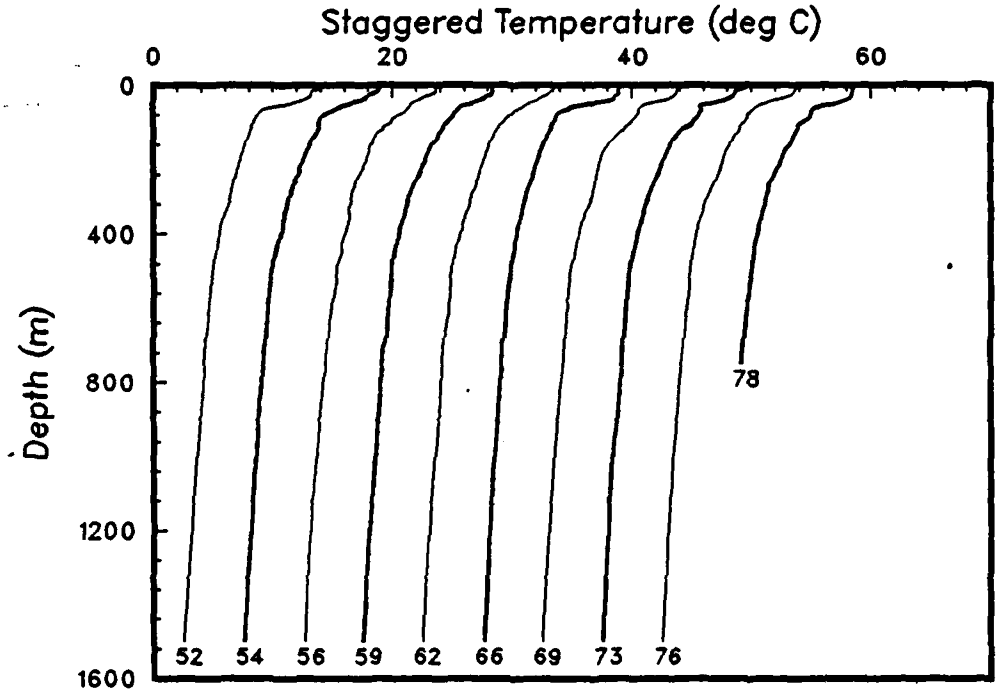
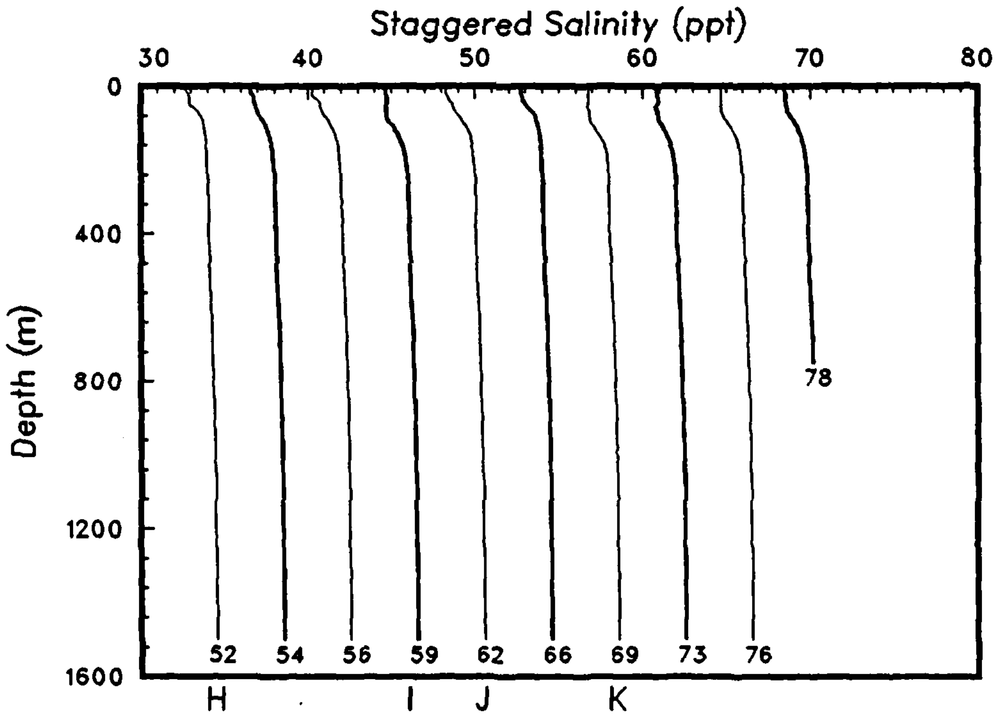


Figure 17(a): CTD temperature profiles, staggered by multiples of 5C, and salinity profiles, staggered by multiples of 4 ppt (OPTOMA16, Leg MII).

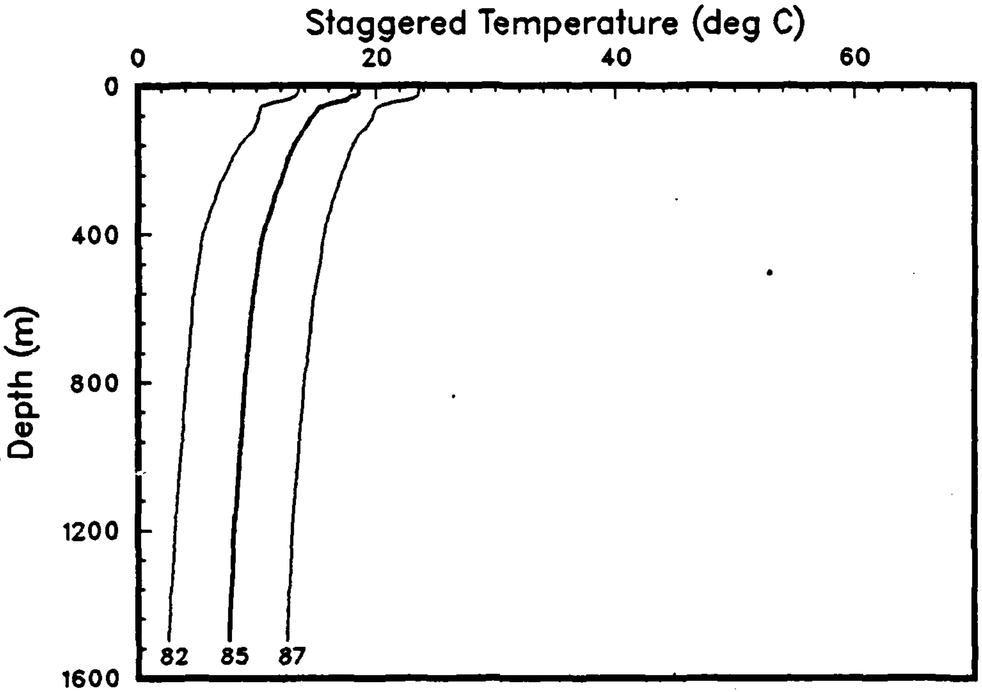


Staggered Temperature (deg C)
0
20
40
60
0
400
800
1200
1600
Depth (m)
78
52
54
56
59
62
66
69
73
76

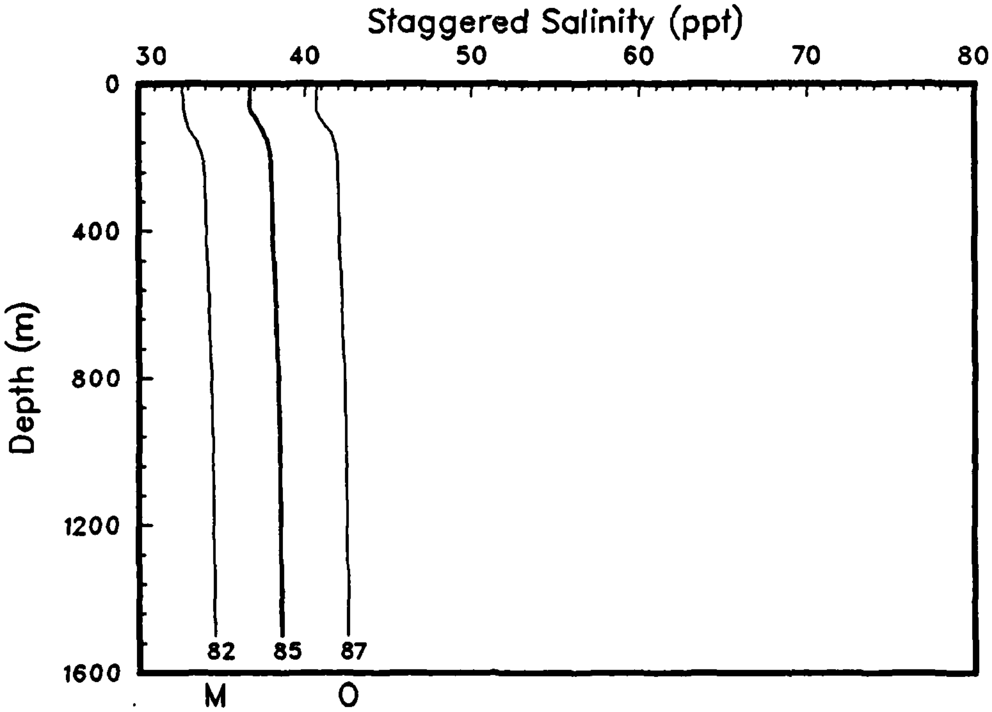


Staggered Salinity (ppt)
30
40
50
60
70
80
0
400
800
1200
1600
Depth (m)
78
52
54
56
59
62
66
69
73
76
H
I
J
K

Figure 17(b)



Staggered Temperature (deg C)
0
20
40
60
0
400
800
1200
1600
Depth (m)
82
85
87



Staggered Salinity (ppt)
30
40
50
60
70
80
0
400
800
1200
1600
Depth (m)
82
85
87
M
O

Figure 17(c)

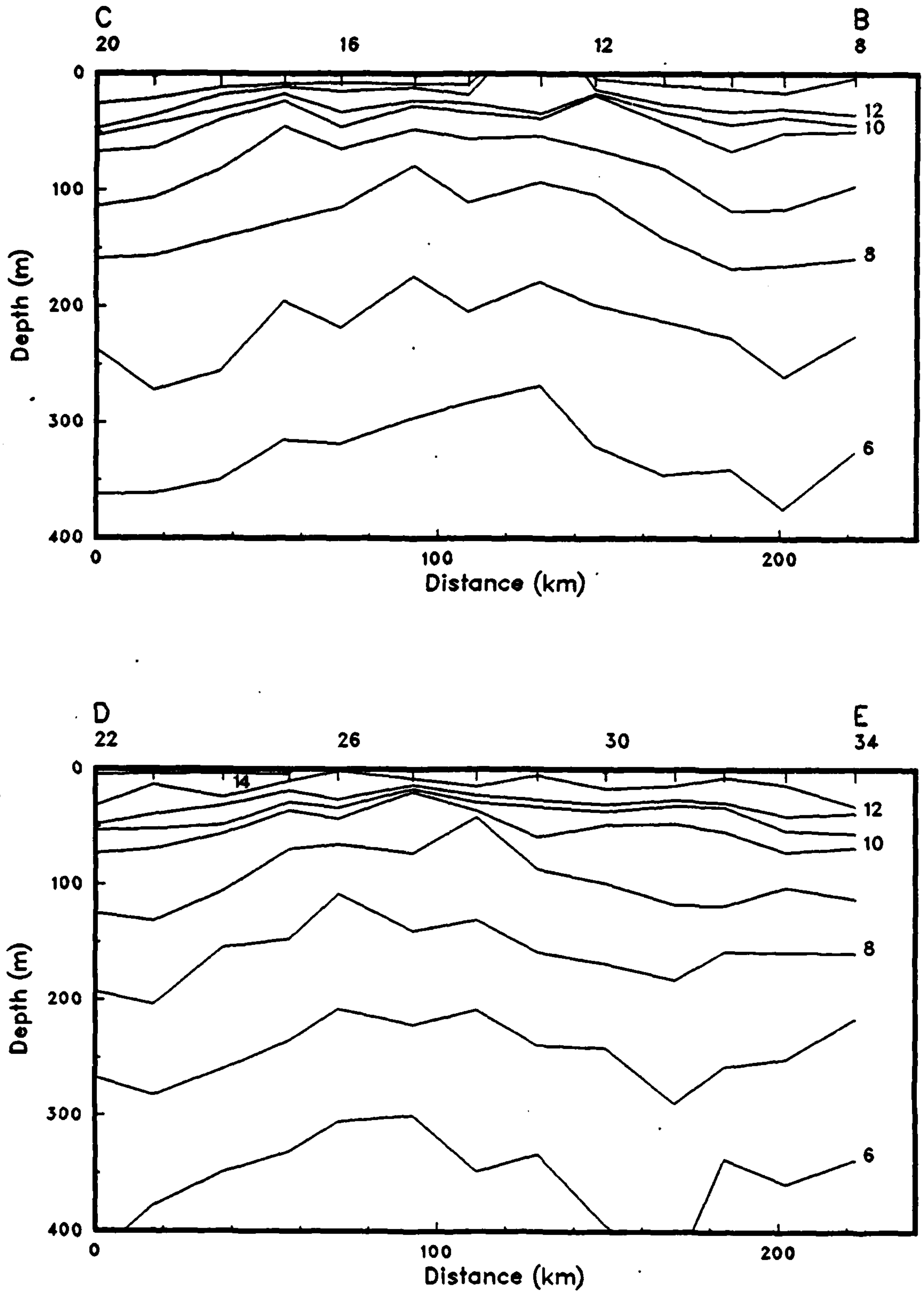


Figure 18 (a)-(b): Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow (OPTOMA16, Leg MII).

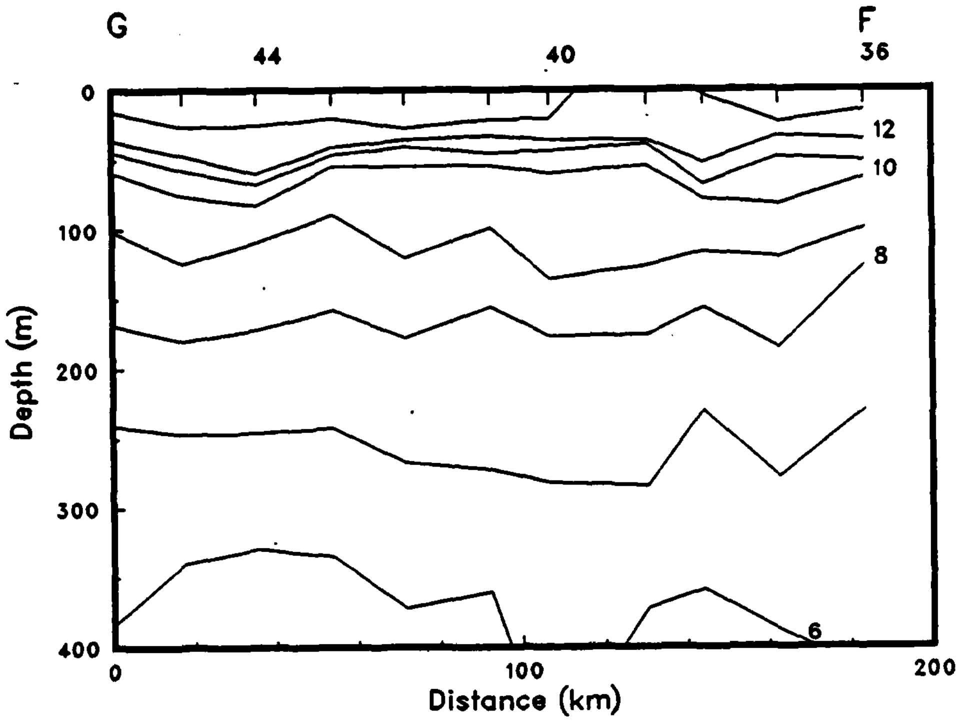


Figure 18(c)

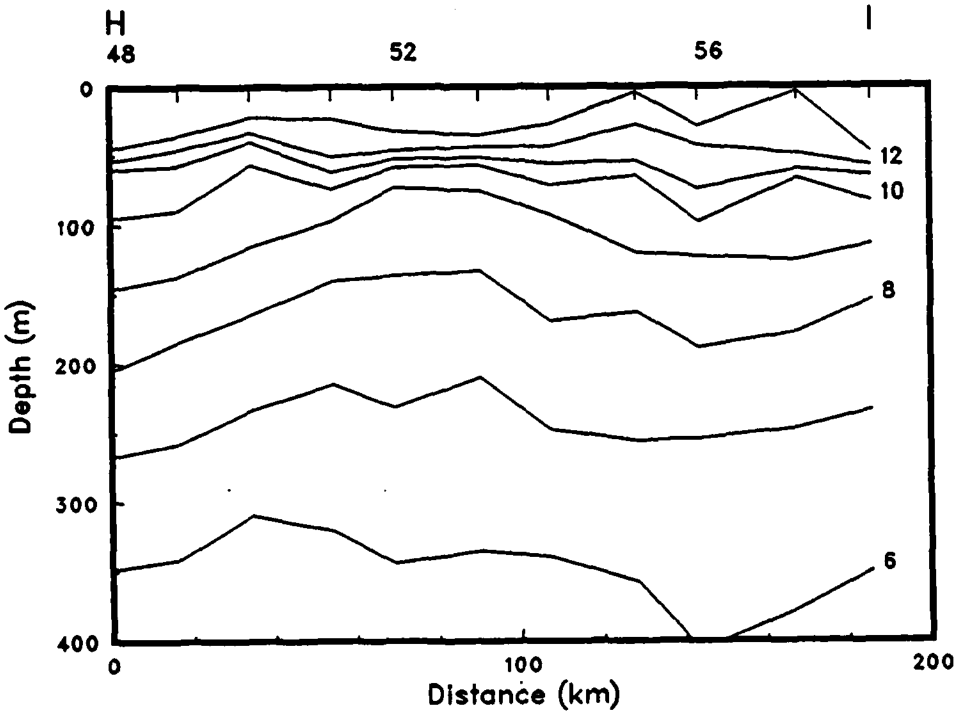


Figure 18(d)

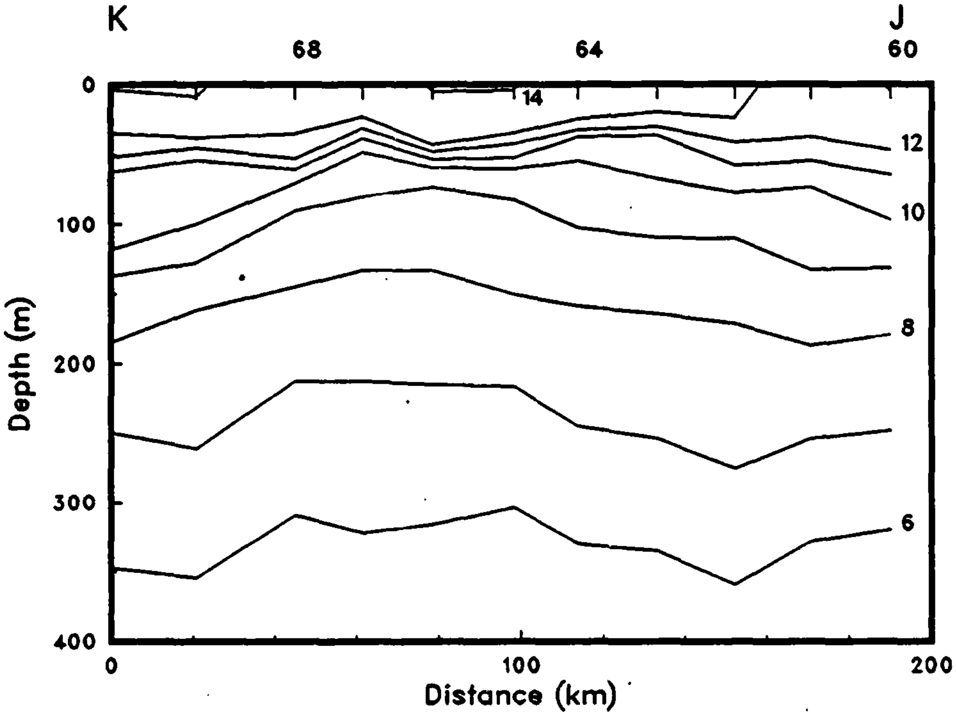


Figure 18(e)

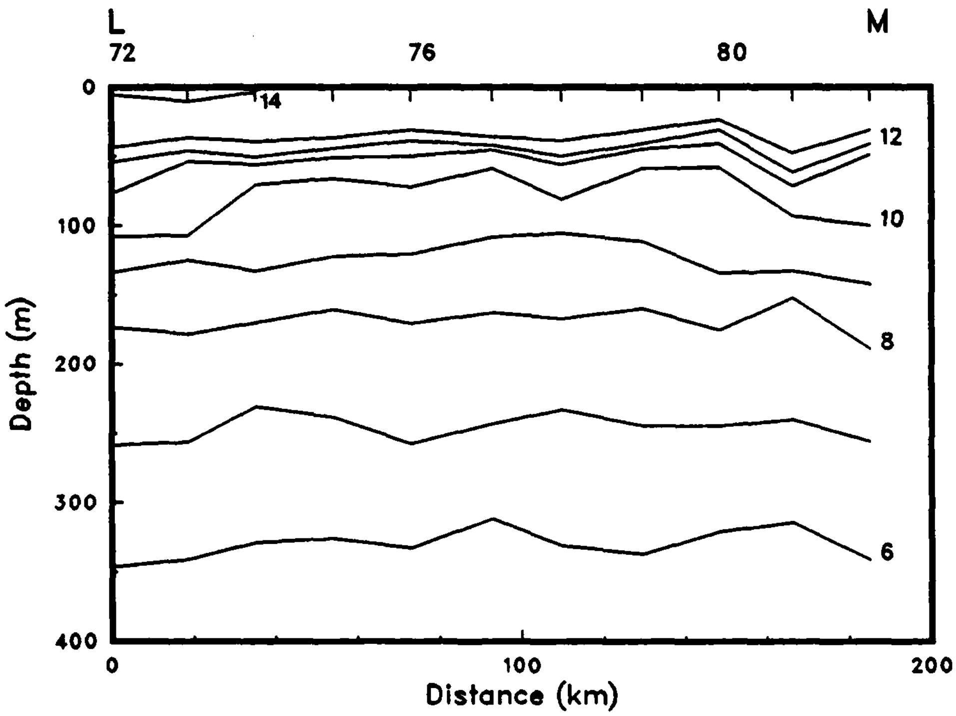


Figure 18(f)

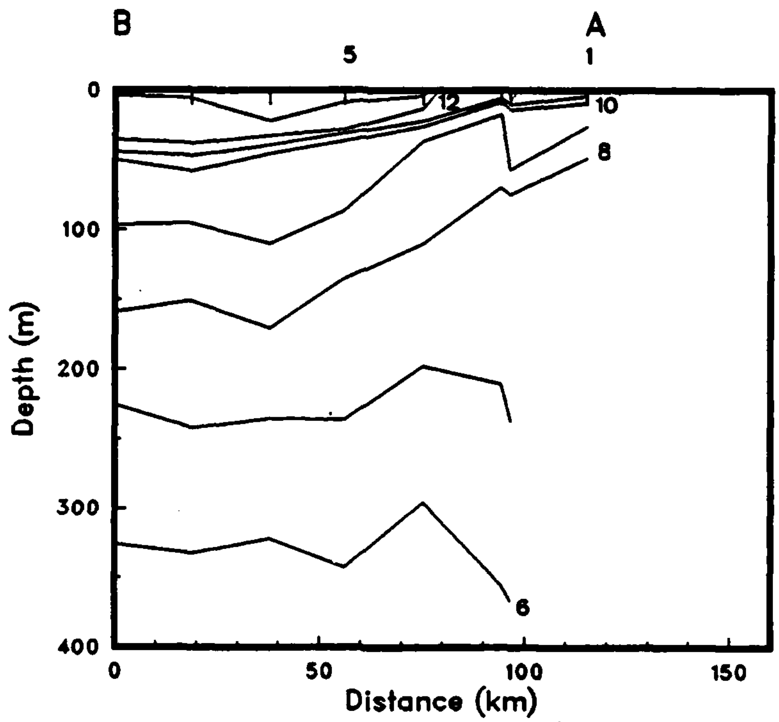


Figure 18(g)

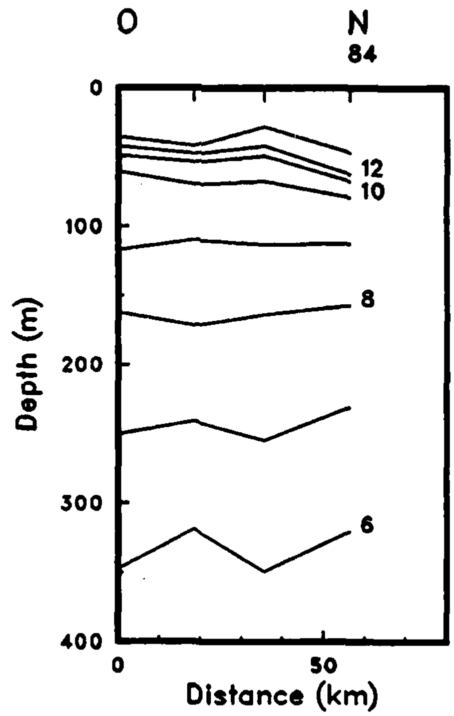


Figure 18(h)

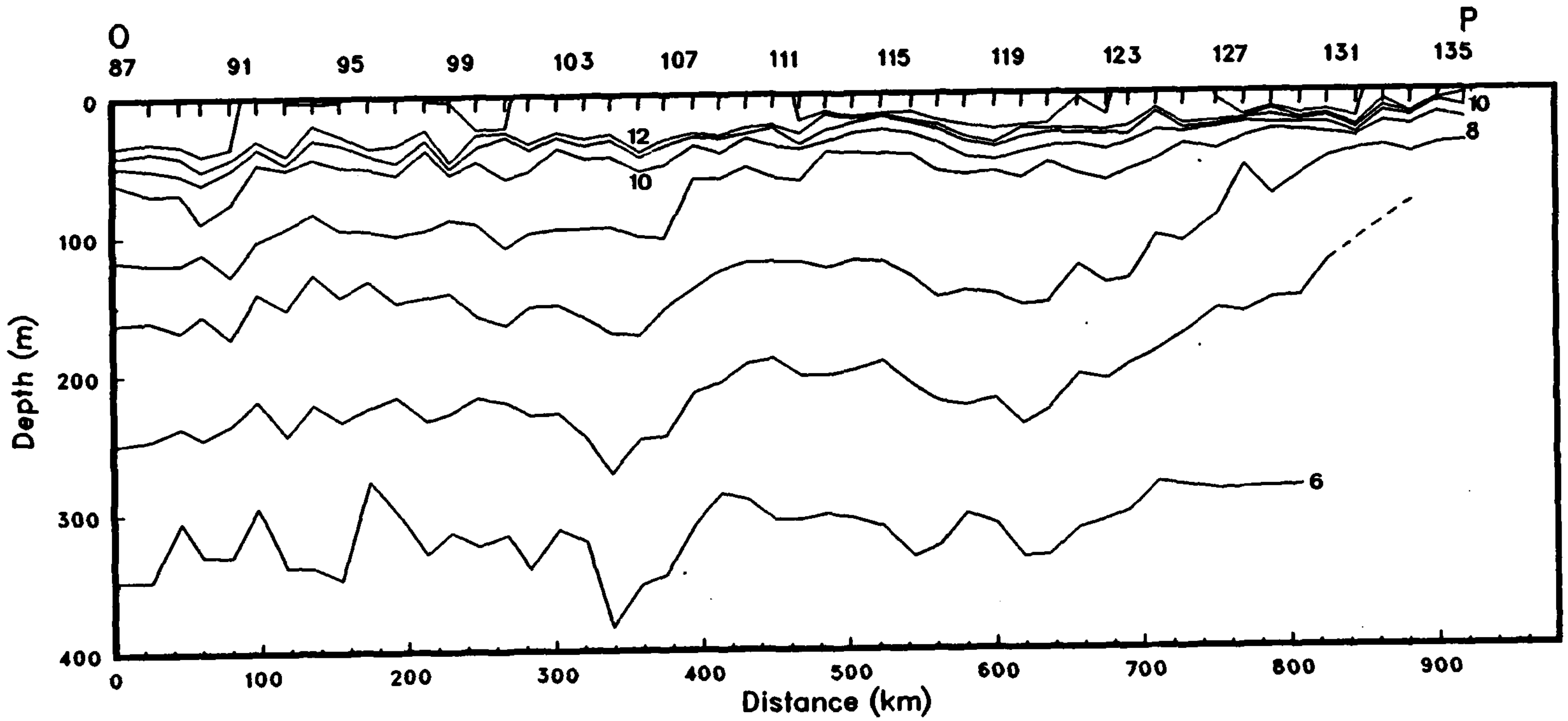

O
P
87
91
95
99
103
107
111
115
119
123
127
131
135
12
10
10
8
6
Depth (m)
0
100
200
300
400
Distance (km)
0
100
200
300
400
500
600
700
800
900

Figure 18(i)

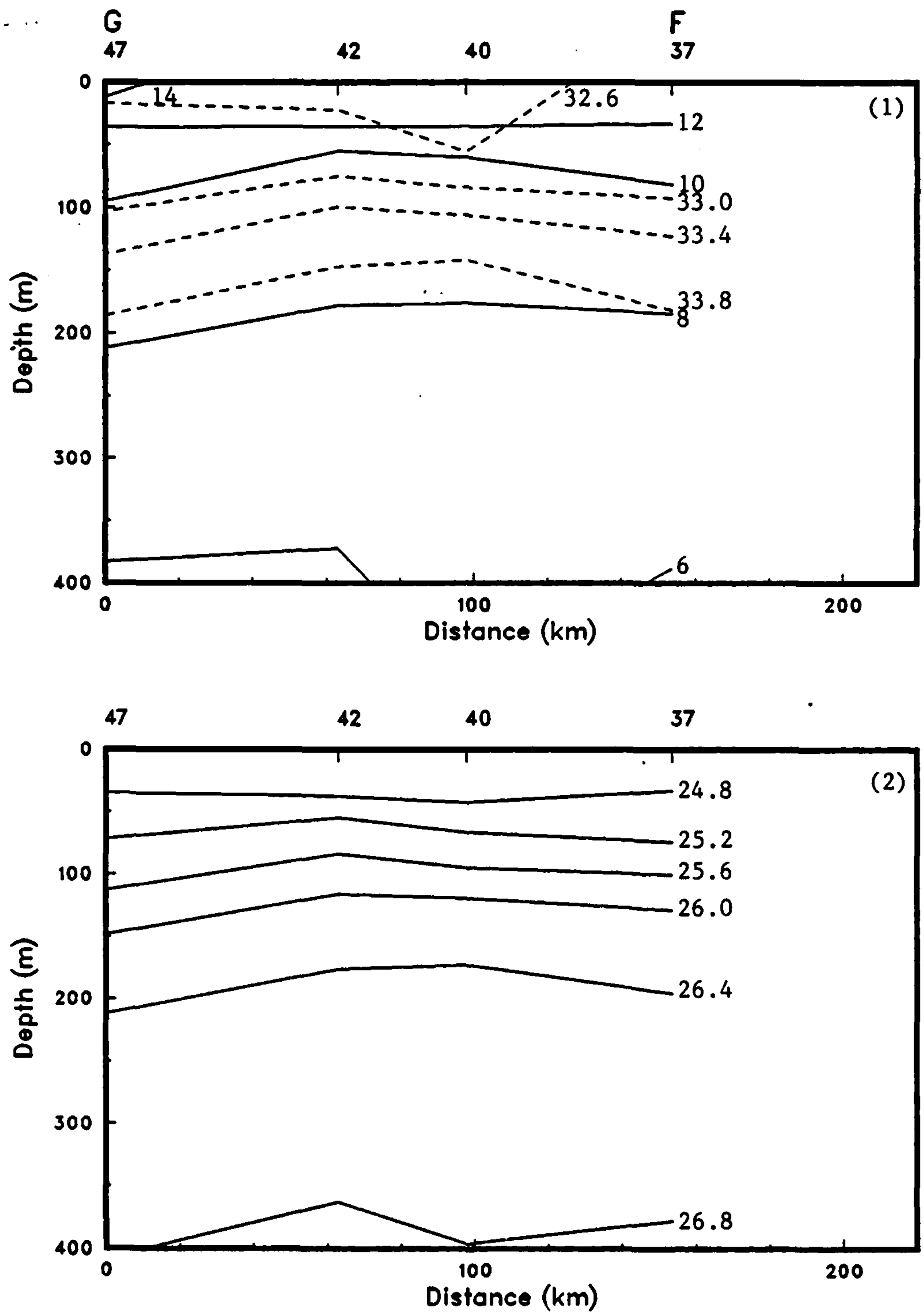
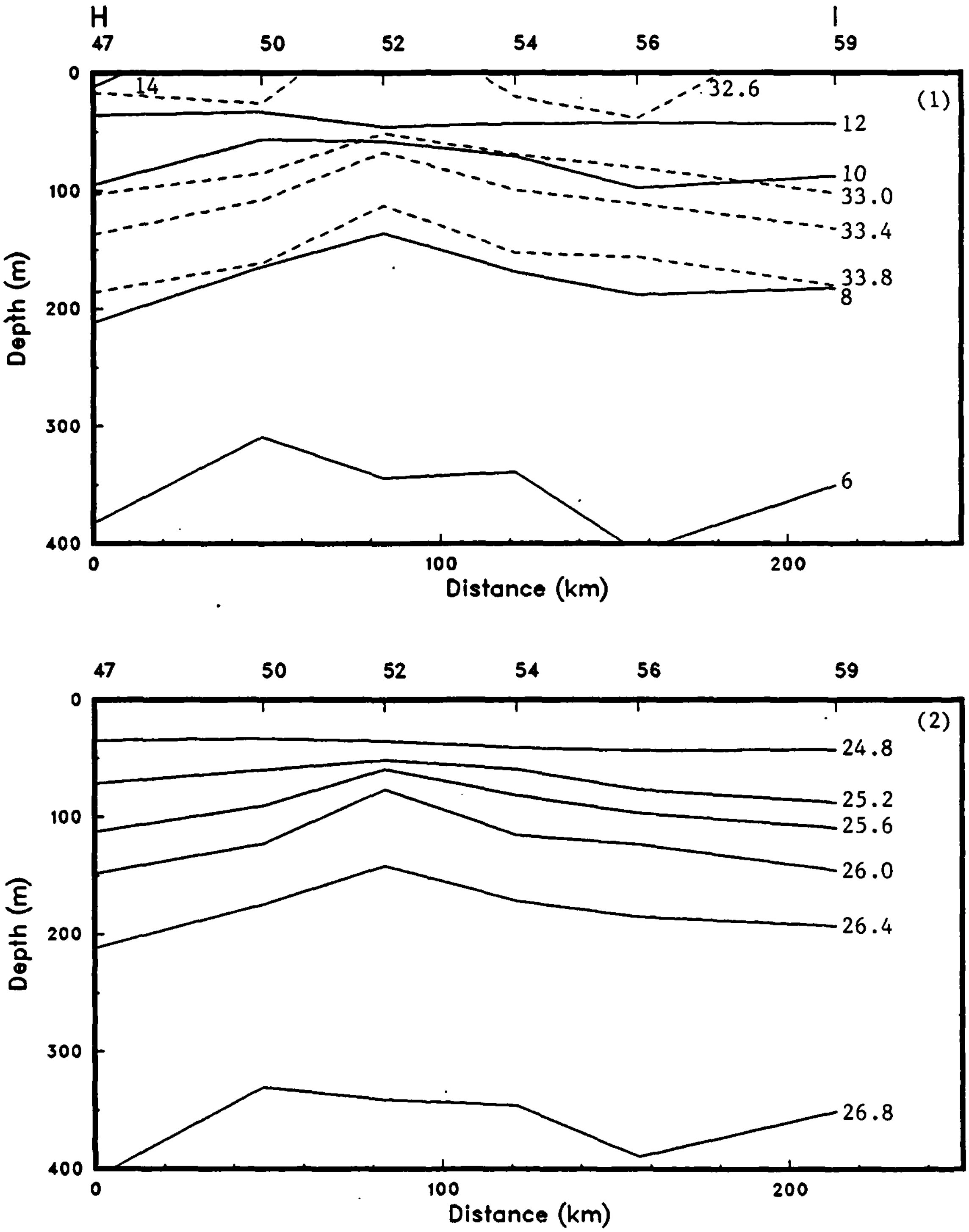
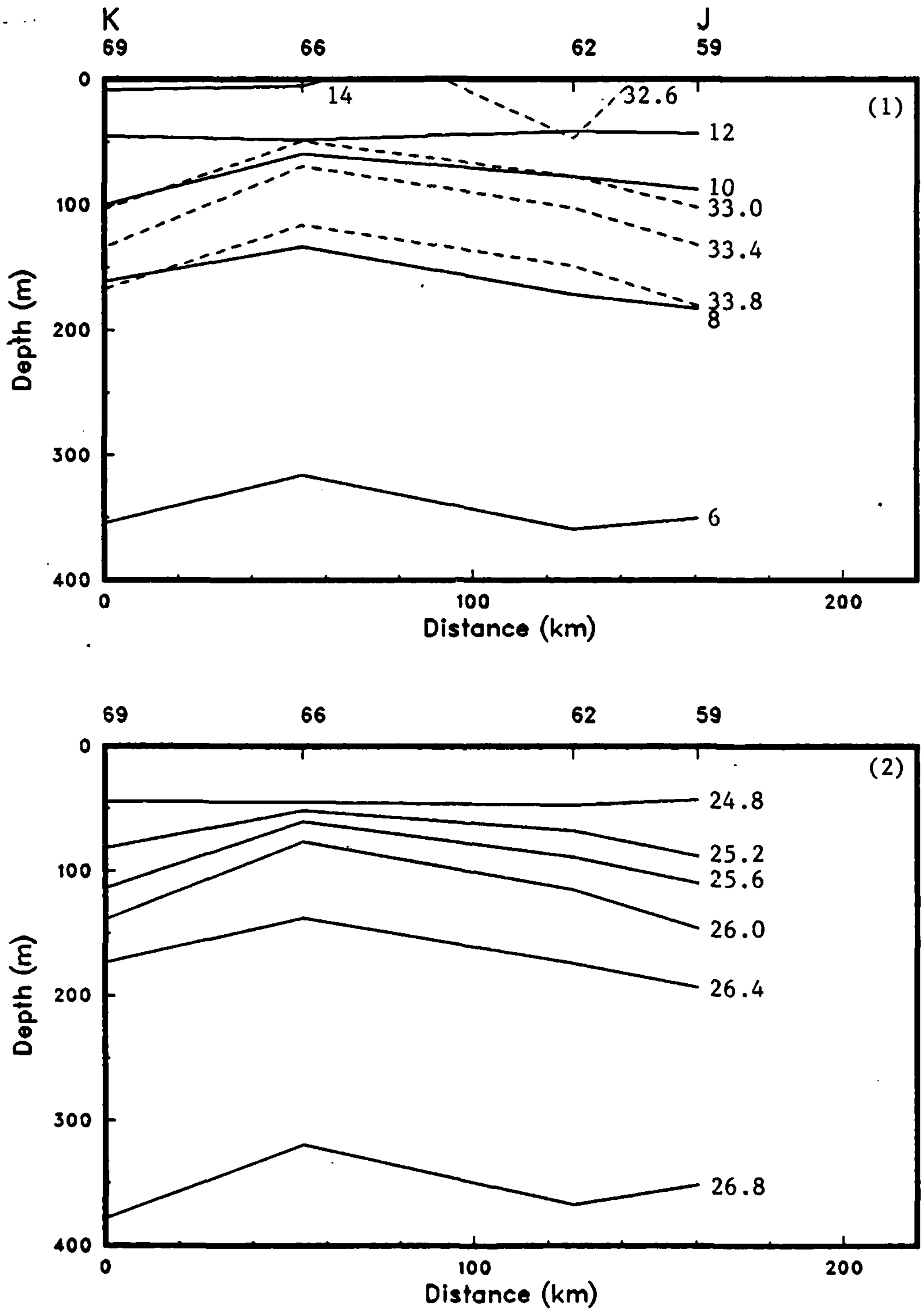


Figure 19(a): Isopleths of (1) temperature and salinity and (2) sigma-t from the CTD's (OPTOMA16, Leg MII).



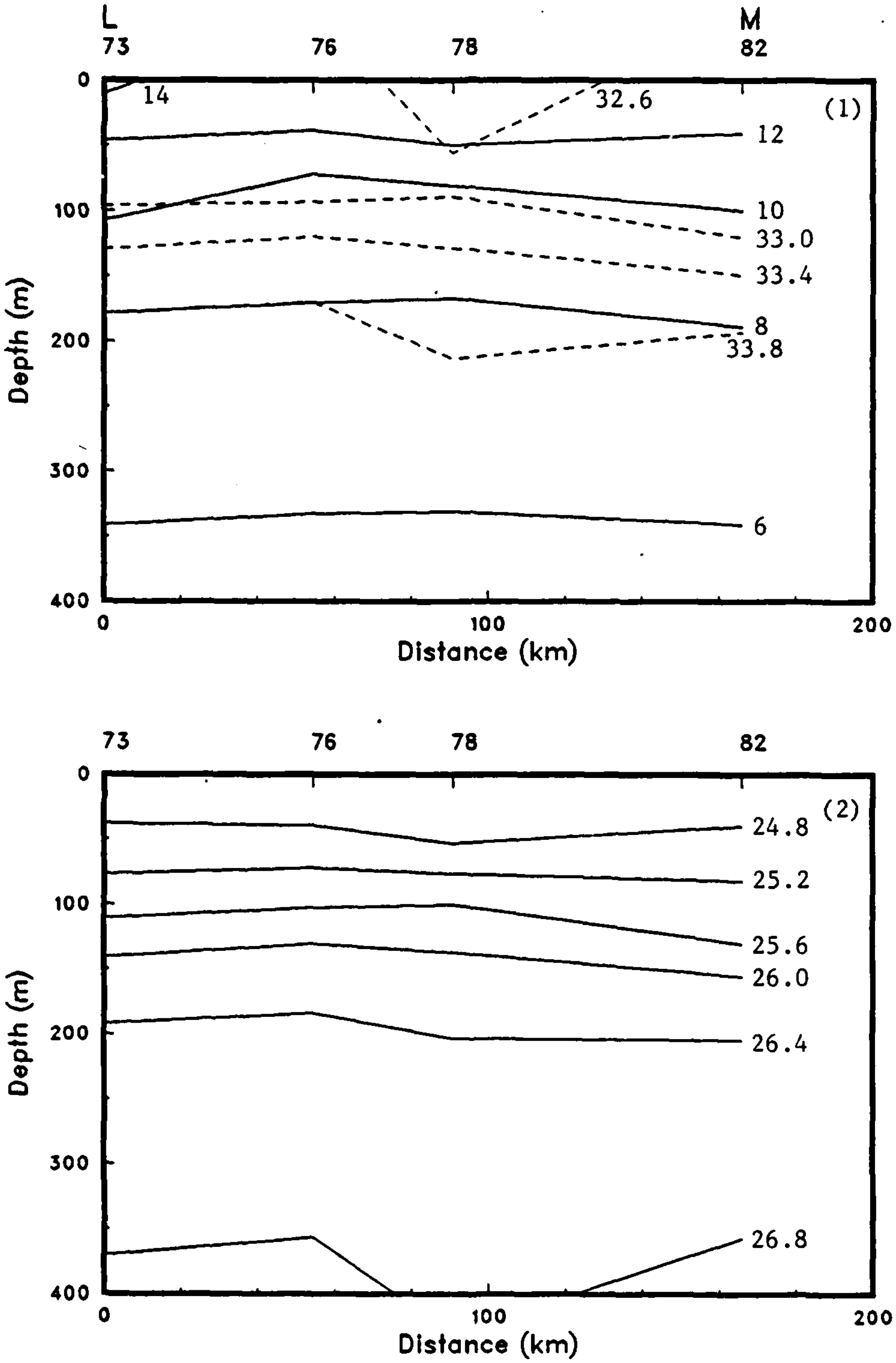
H
I
47
50
52
54
56
59
(1)
14
32.6
12
10
33.0
33.4
33.8
8
6
Depth (m)
Distance (km)
(2)
24.8
25.2
25.6
26.0
26.4
26.8

Figure 19(b)



K
J
69
66
62
59
14
32.6
12
10
33.0
33.4
33.8
8
6
(1)
Depth (m)
Distance (km)
0
100
200
300
400
69
66
62
59
24.8
25.2
25.6
26.0
26.4
26.8
(2)
Depth (m)
Distance (km)

Figure 19(c)



L
M
73
76
78
82
14
32.6
(1)
12
10
33.0
33.4
8
33.8
6
Depth (m)
0
100
200
300
400
Distance (km)
0
100
200
73
76
78
82
(2)
24.8
25.2
25.6
26.0
26.4
26.8
Depth (m)
0
100
200
300
400
Distance (km)
0
100
200

Figure 19(d)

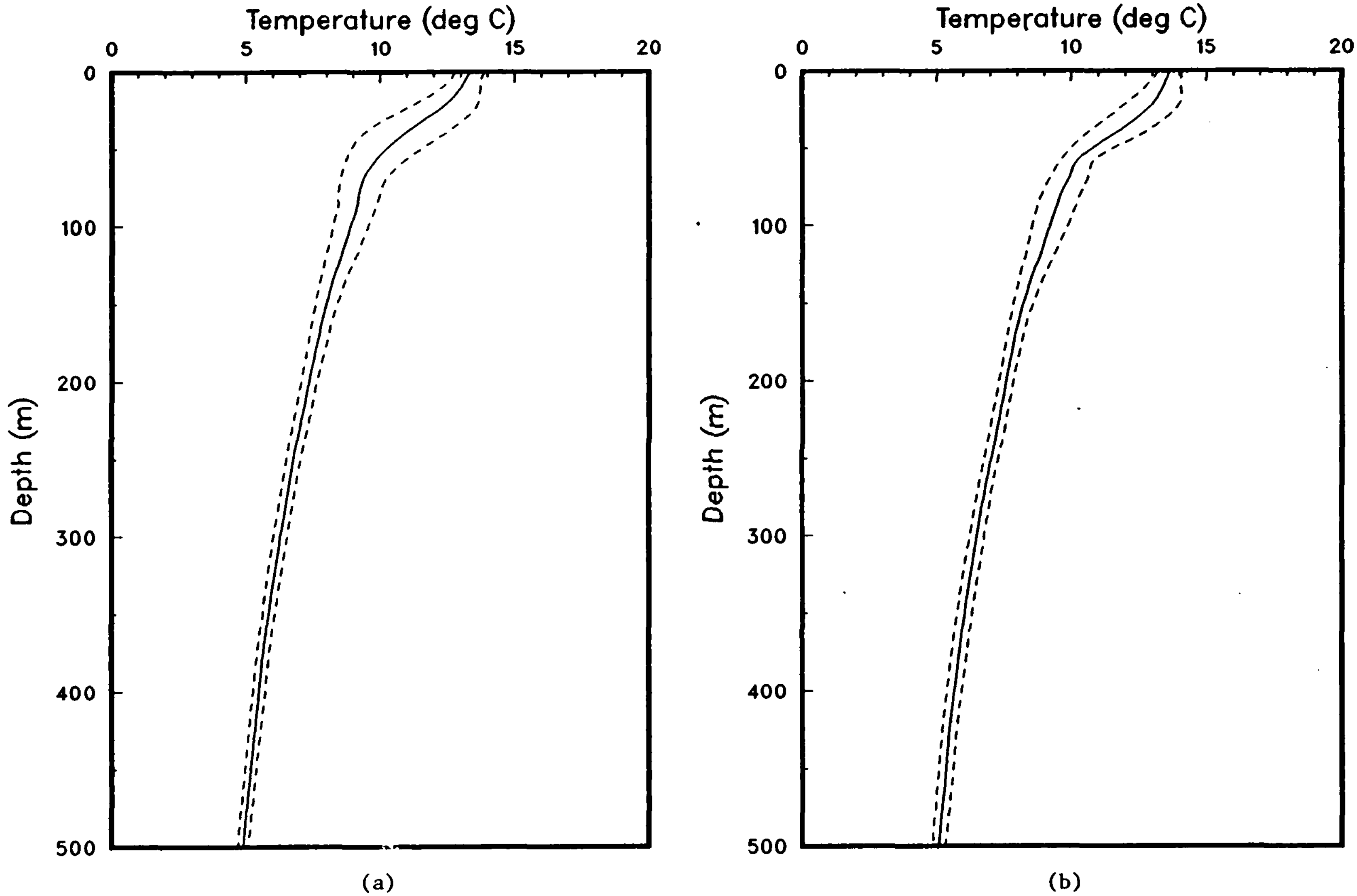


Figure 20: Mean temperature profiles from (a) XBT's and (b) CTD's, with + and - the standard deviation (OPTOMA16, Leg MII).

AD-A160 270 HYDROGRAPHIC DATA FROM THE OPTOMA (OCEAN PREDICTION THROUGH OBSERVATIONS..(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA P A WITTMANN ET AL. AUG 85 NPS-68-85-023 2/2

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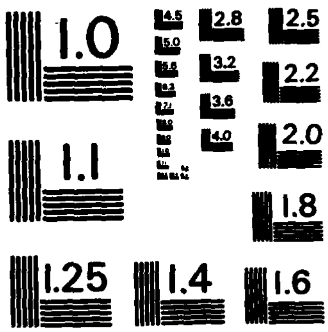
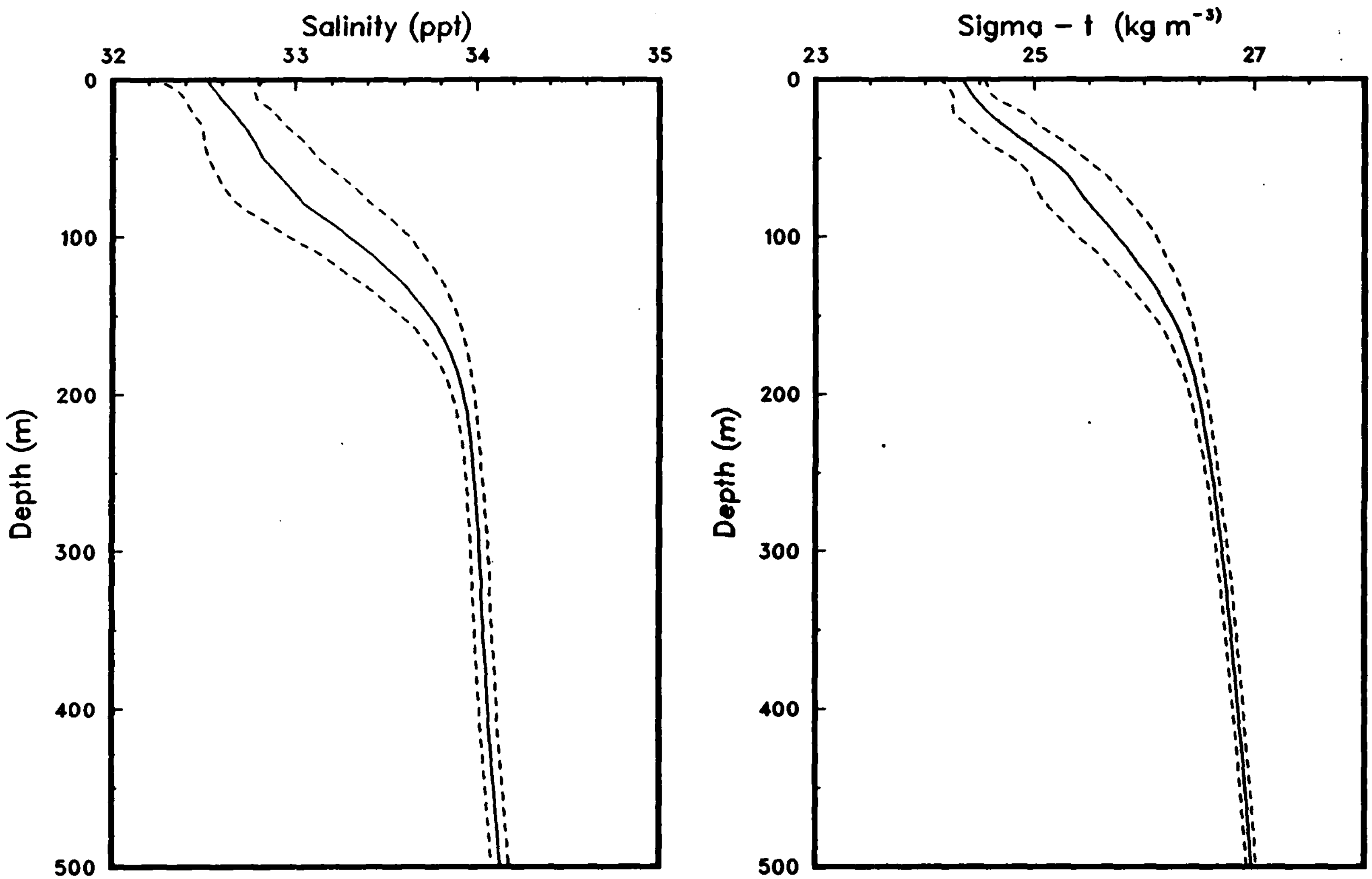
END



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



(a) (b)

Figure 21: Mean profiles of (a) salinity and (b) sigma-t, with + and - the standard deviations, from the CTD's (OPTOMA16, Leg MII).

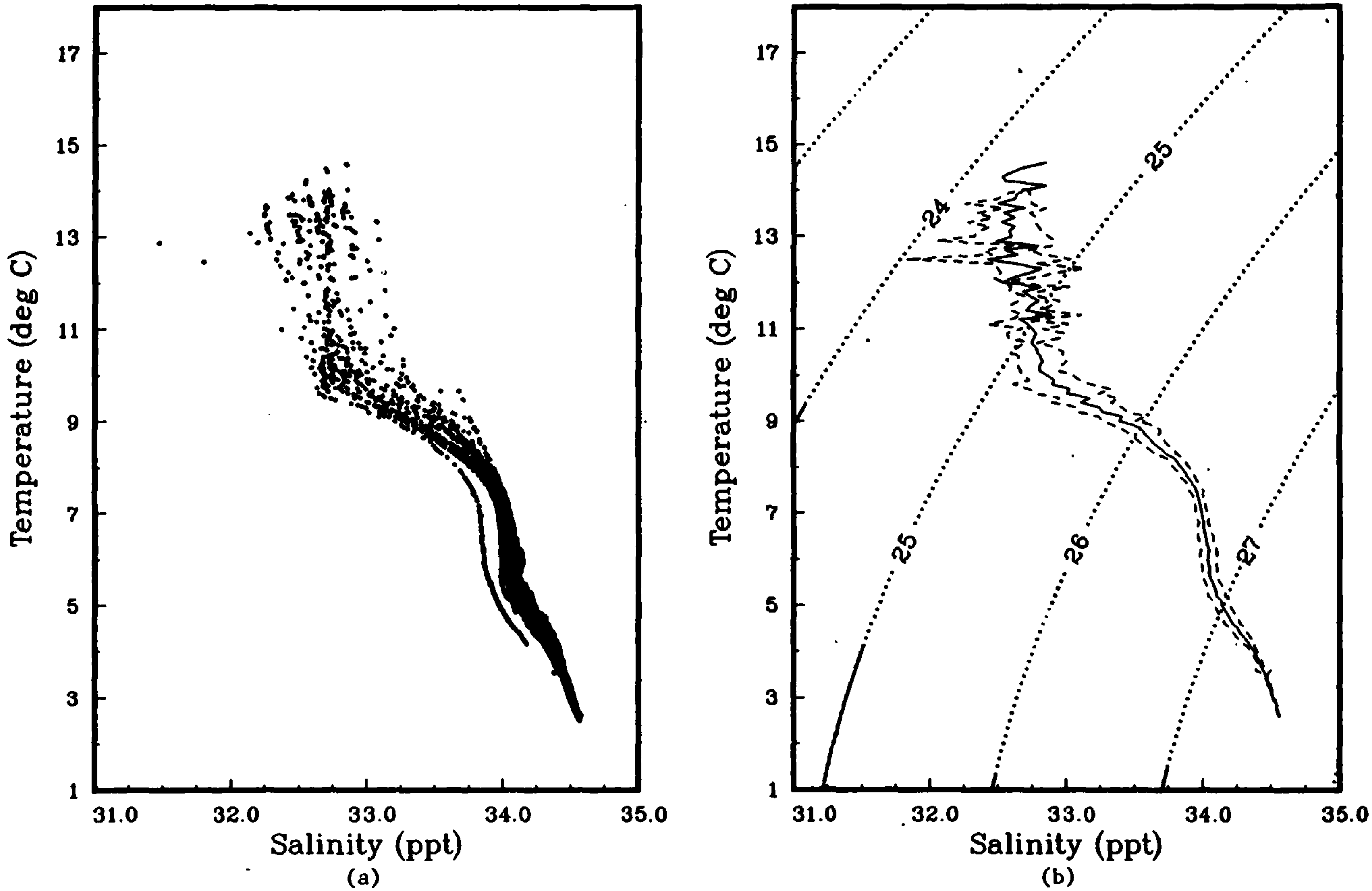


Figure 22: (a) T-S pairs and (b) mean T-S relation, with + and - the standard deviation, from the CTD's. Selected sigma-t contours are also shown (OPTOMA16, Leg MII).

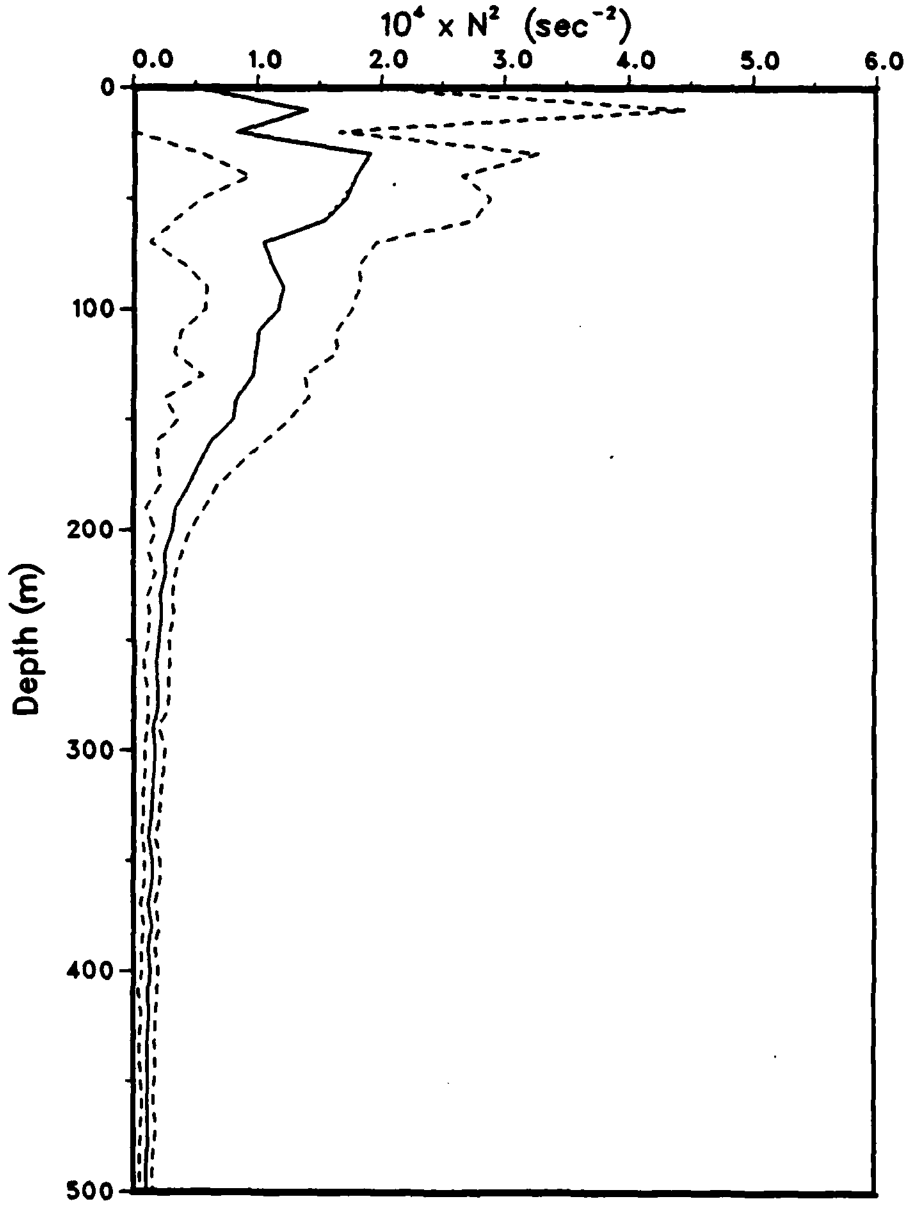


Figure 23: Mean N^2 profile (——), with + and - the standard deviation (---). The N^2 profile from $\overline{T(z)}$ ans $\overline{S(z)}$ is also shown (...) (OPTOMA16, LegMII).

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SECTION 3

OPTOMA16 LEG A

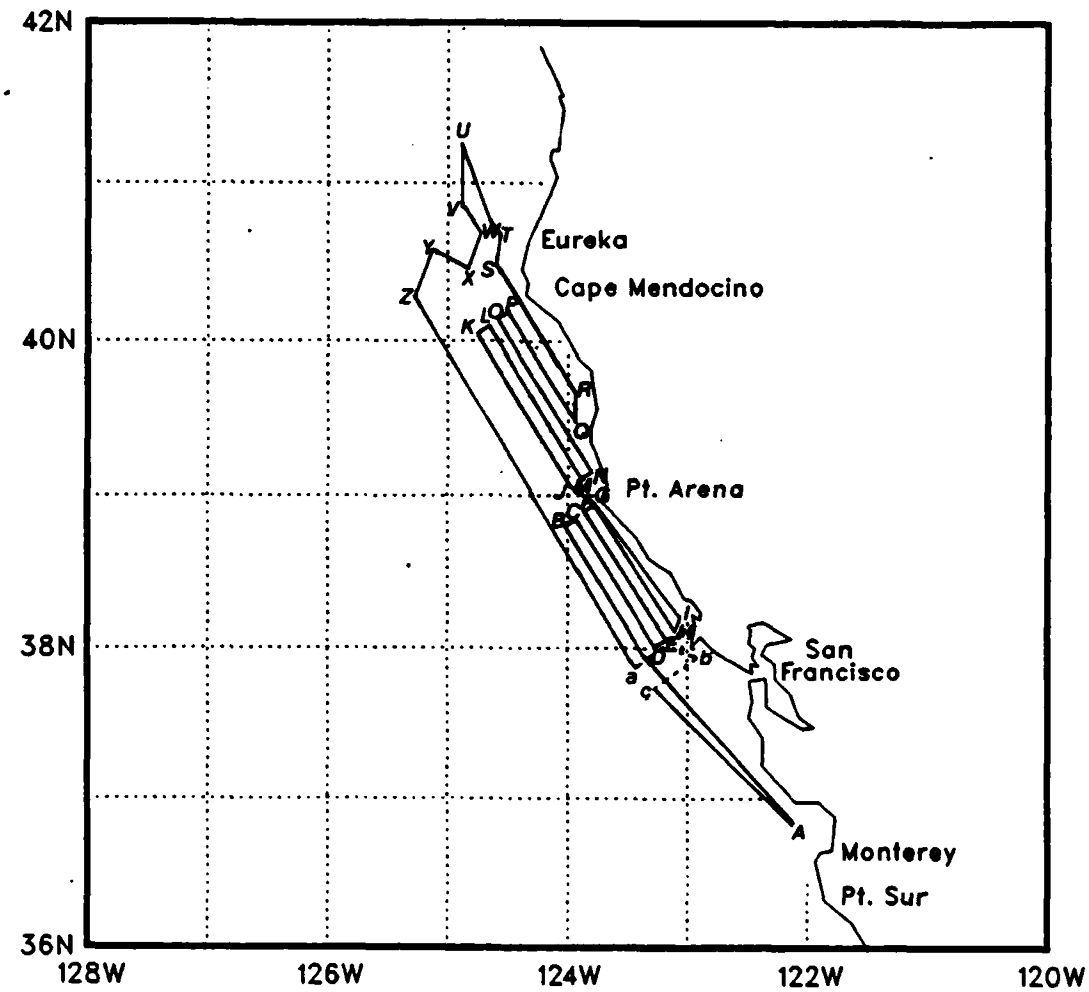


Figure 24: The cruise track for OPTOMA16, Leg A.

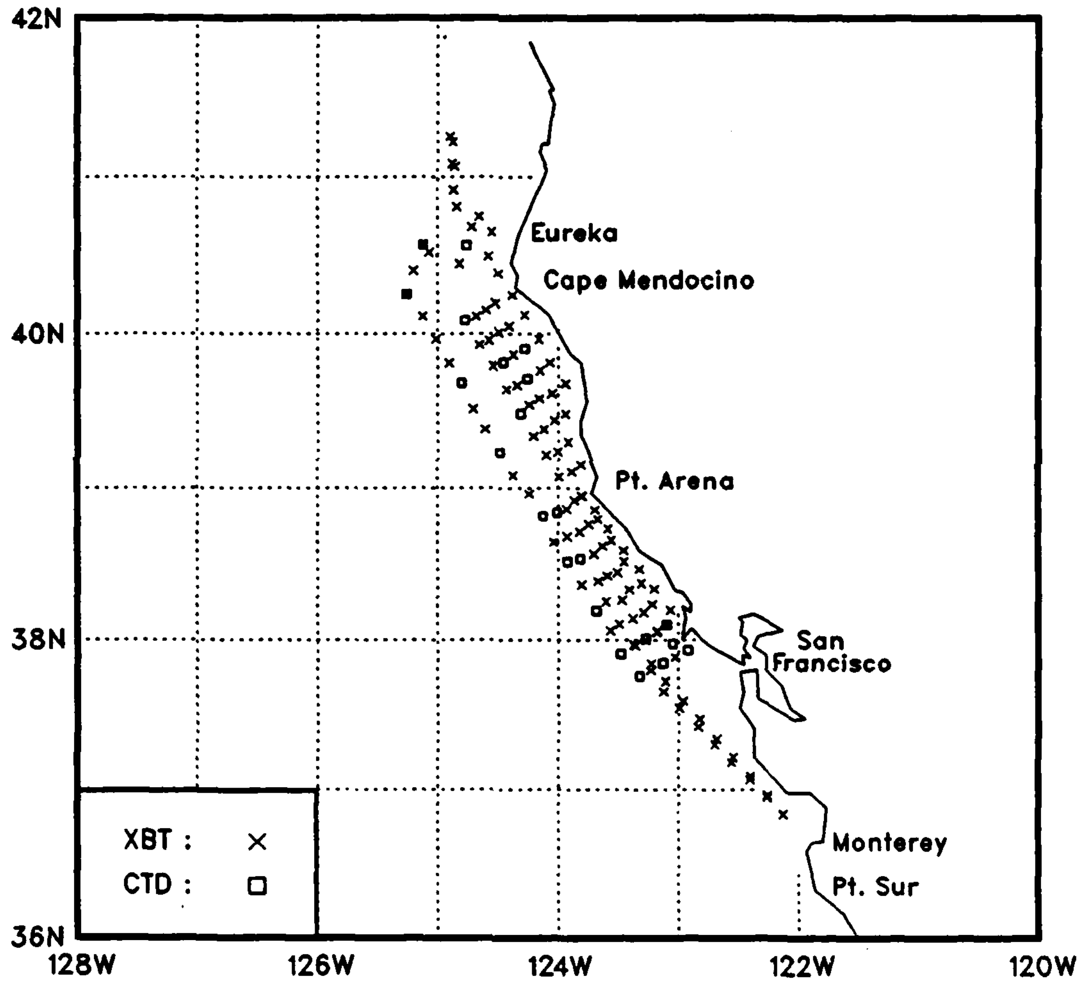


Figure 25: XBT and CTD locations for OPTOMA16, Leg A.

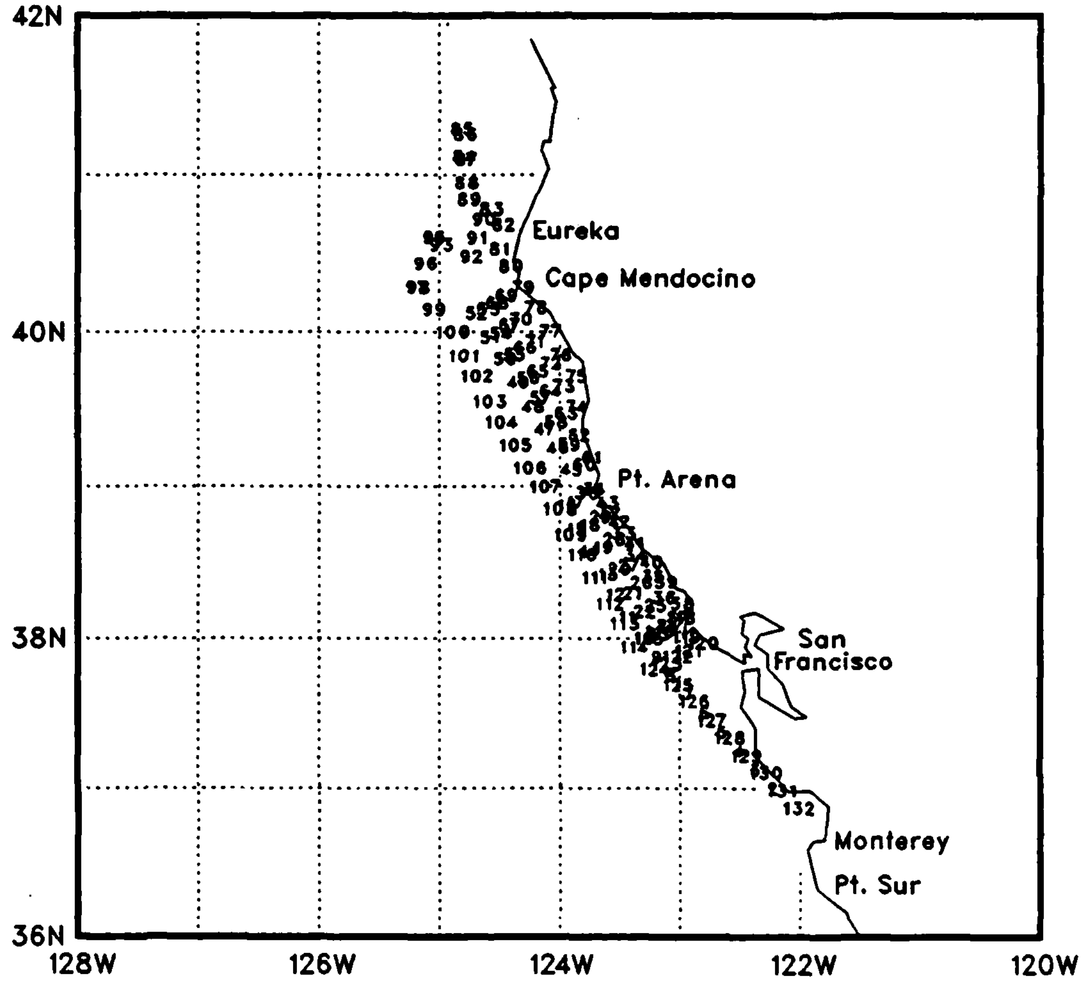


Figure 26: Station numbers for OPTOMA16, Leg A.

Table 5 : Leg A Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	85164	1751	36.50	122.08	12.3			
2	XBT	85164	1904	36.58	122.16	12.0			
3	XBT	85164	2014	37.06	122.24	11.9			
4	XBT	85164	2126	37.13	122.33	12.3			
5	XBT	85164	2243	37.21	122.41	13.1			
6	XBT	85165	7	37.29	122.50	14.0			
7	XBT	85165	125	37.36	122.58	13.3			
8	XBT	85165	311	37.43	123.06	11.5			
9	XBT	85165	956	37.51	123.14	10.2			
10	XBT	85166	52	37.58	123.22	10.1			
11	XBT	85166	1912	38.06	123.29	9.0			
12	XBT	85167	901	38.15	123.36	9.1			
13	XBT	85167	1340	38.23	123.40	9.2			
14	CTD	85167	1628	38.32	123.49	10.3	33.60	10.7	33.58
15	XBT	85167	1804	38.41	123.55	11.7			
16	CTD	85167	2000	38.50	124.00	11.7	33.30	12.3	33.29
17	XBT	85167	2044	38.52	123.55	10.5			
18	XBT	85167	2152	38.43	123.49	10.9			
19	XBT	85167	2302	38.34	123.42	10.4			
20	XBT	85168	13	38.25	123.35	9.3			
21	XBT	85168	129	38.16	123.28	9.5			
22	XBT	85168	257	38.09	123.23	9.8			
23	XBT	85168	515	38.00	123.16	10.2			
24	XBT	85168	557	38.03	123.11	10.5			
25	XBT	85168	703	38.11	123.17	9.9			
26	XBT	85168	828	38.20	123.24	9.4			
27	XBT	85168	936	38.27	123.30	8.7			
28	XBT	85168	1046	38.37	123.38	10.8			
29	XBT	85168	1157	38.46	123.45	10.7			
30	XBT	85168	1319	38.55	123.52	10.0			
31	XBT	85168	1345	38.57	123.48	9.0			
32	XBT	85168	1510	38.48	123.40	8.6			
33	XBT	85168	1635	38.39	123.33	8.7			
34	XBT	85168	1812	38.31	123.27	9.5			
35	XBT	85168	1941	38.23	123.18	9.4			
36	XBT	85168	2043	38.14	123.13	10.1			
37	XBT	85168	2158	38.06	123.06	11.3			
38	XBT	85168	2242	38.12	123.04	11.1			
39	XBT	85169	35	38.20	123.12	10.4			
40	XBT	85169	140	38.28	123.19	10.0			
41	XBT	85169	246	38.35	123.27	9.8			
42	XBT	85169	351	38.44	123.35	9.8			
43	XBT	85169	459	38.51	123.41	9.4			
44	XBT	85169	541	38.57	123.48	9.8			
45	XBT	85169	702	39.04	123.59	10.2			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
46	XBT	85169	815	39.13	124.06	12.6			
47	XBT	85169	925	39.20	124.12	13.0			
48	CTD	85169	1114	39.29	124.18	13.2	32.35	13.2	32.32
49	XBT	85169	1305	39.39	124.25	13.0			
50	XBT	85169	1421	39.48	124.32	13.3			
51	XBT	85169	1532	39.56	124.39	11.8			
52	CTD	85169	1701	40.05	124.46	12.4	32.58	12.3	32.56
53	XBT	85169	1741	40.07	124.40	12.4			
54	XBT	85169	1855	39.57	124.34	12.2			
55	CTD	85169	2012	39.49	124.27	13.5	32.29	13.7	32.34
56	XBT	85169	2130	39.40	124.20	13.2			
57	XBT	85169	2231	39.33	124.14	10.7			
58	XBT	85169	2343	39.23	124.07	13.3			
59	XBT	85170	47	39.14	124.00	11.4			
60	XBT	85170	200	39.07	123.53	10.6			
61	XBT	85170	232	39.09	123.48	9.9			
62	XBT	85170	346	39.18	123.55	10.1			
63	XBT	85170	505	39.26	124.02	12.3			
64	XBT	85170	617	39.35	124.09	10.0			
65	CTD	85170	743	39.43	124.15	12.9	32.46	12.9	32.40
66	XBT	85170	928	39.52	124.22	12.7			
67	XBT	85170	1047	40.01	124.29	12.6			
68	XBT	85170	1209	40.09	124.36	11.4			
69	XBT	85170	1245	40.12	124.31	10.9			
70	XBT	85170	1357	40.03	124.24	12.9			
71	CTD	85170	1515	39.54	124.16	13.1	32.59	13.2	32.56
72	XBT	85170	1651	39.46	124.09	10.0			
73	XBT	85170	1801	39.37	124.03	10.0			
74	XBT	85170	1919	39.29	123.56	10.6			
75	XBT	85170	2029	39.41	123.56	9.7			
76	XBT	85170	2143	39.49	124.04	10.4			
77	XBT	85170	2257	39.58	124.09	11.4			
78	XBT	85171	29	40.07	124.17	12.1			
79	XBT	85171	151	40.15	124.23	10.6			
80	XBT	85171	315	40.23	124.29	9.5			
81	XBT	85171	448	40.30	124.34	9.2			
82	XBT	85171	650	40.39	124.33	10.5			
83	XBT	85171	1345	40.45	124.39	10.8			
84	XBT	85172	710	41.05	124.53	9.8			
85	XBT	85172	1512	41.15	124.53	9.4			
86	XBT	85172	1901	41.13	124.52	9.6			
87	XBT	85172	2005	41.04	124.51	10.3			
88	XBT	85172	2107	40.55	124.52	10.1			
89	XBT	85172	2154	40.49	124.50	11.1			
90	XBT	85172	2301	40.41	124.43	10.2			

STN	TYPE	YR/DAY	GMT	LAT (NORTH) DD.MM	LONG (WEST) DDD.MM	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
91	CTD	85173	16	40.34	124.45	9.8	33.73	10.3	33.74
92	XBT	85173	132	40.27	124.49	11.9			
93	XBT	85173	328	40.32	125.04	10.4			
94	XBT	85173	410	40.35	125.07	11.0			
95	CTD	85173	426	40.34	125.07	11.1	33.31	11.3	33.31
96	XBT	85173	558	40.24	125.12	12.8			
97	CTD	85173	725	40.15	125.15	12.7	32.76	12.6	32.99
98	XBT	85173	747	40.15	125.16	12.4			
99	XBT	85173	904	40.07	125.07	12.0			
100	XBT	85173	1015	39.58	125.01	13.0			
101	XBT	85173	1129	39.49	124.54	13.6			
102	CTD	85173	1257	39.41	124.48	14.3	32.52	13.8	32.49
103	XBT	85173	1433	39.31	124.42	14.5			
104	XBT	85173	1539	39.23	124.36	13.4			
105	CTD	85173	1704	39.14	124.29	13.9	32.30	14.0	32.37
106	XBT	85173	1834	39.05	124.22	13.1			
107	XBT	85173	1941	38.58	124.14	12.3			
108	CTD	85173	2105	38.49	124.07	12.0	33.04	12.6	32.92
109	XBT	85173	2240	38.39	124.02	12.6			
110	CTD	85174	2	38.31	123.55	12.6	32.88	13.3	32.83
111	XBT	85174	134	38.22	123.48	12.5			
112	CTD	85174	259	38.12	123.41	12.7	33.61	13.0	33.58
113	XBT	85174	415	38.04	123.34	11.7			
114	CTD	85174	539	37.54	123.29	14.0	32.88	14.1	32.84
115	XBT	85174	646	37.58	123.21	13.2			
116	CTD	85174	728	38.01	123.16	13.3	33.51	13.7	33.52
117	XBT	85174	832	38.04	123.10	14.1			
118	CTD	85174	906	38.06	123.06	14.7	32.92	14.1	33.17
119	CTD	85174	1027	37.59	123.03	14.4	33.26	14.1	33.25
120	CTD	85174	1132	37.56	122.55	14.6	33.72	14.0	33.25
121	XBT	85174	1223	37.53	123.02	13.1			
122	CTD	85174	1305	37.51	123.08	12.4	33.56	12.6	32.84
123	XBT	85174	1353	37.48	123.14	12.4			
124	CTD	85174	1443	37.46	123.19	12.4	33.34	12.8	33.34
125	XBT	85174	1613	37.39	123.07	12.5			
126	XBT	85174	1715	37.33	123.00	13.1			
127	XBT	85174	1828	37.25	122.50	13.2			
128	XBT	85174	1932	37.18	122.42	14.0			
129	XBT	85174	2038	37.11	122.34	14.0			
130	XBT	85174	2146	37.04	122.24	14.6			
131	XBT	85174	2253	36.57	122.16	14.8			
132	XBT	85175	5	36.50	122.08	14.4			

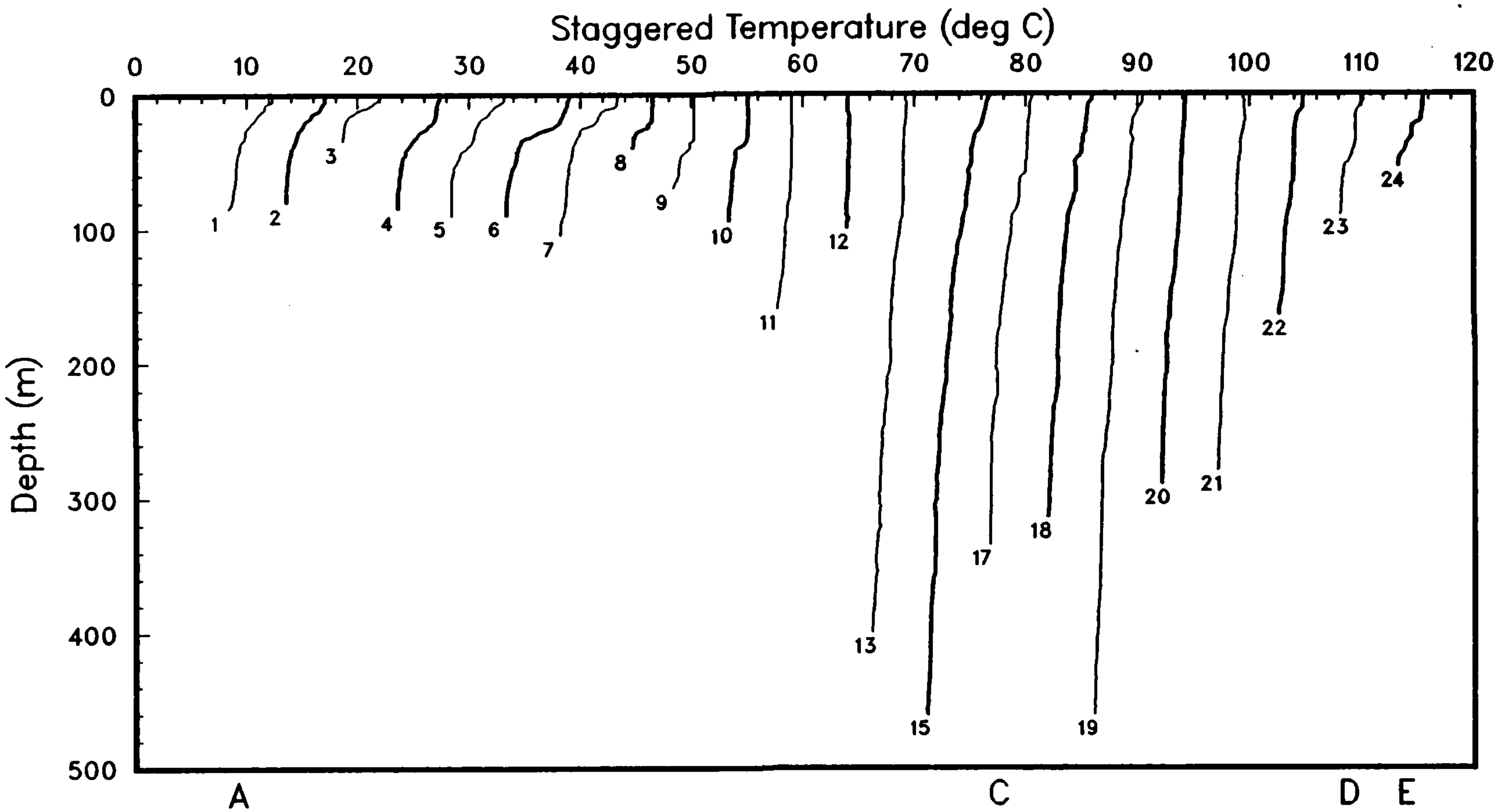


Figure 27(a): XBT temperature profiles, staggered by multiples of 5C (OPTOMA16, Leg A).

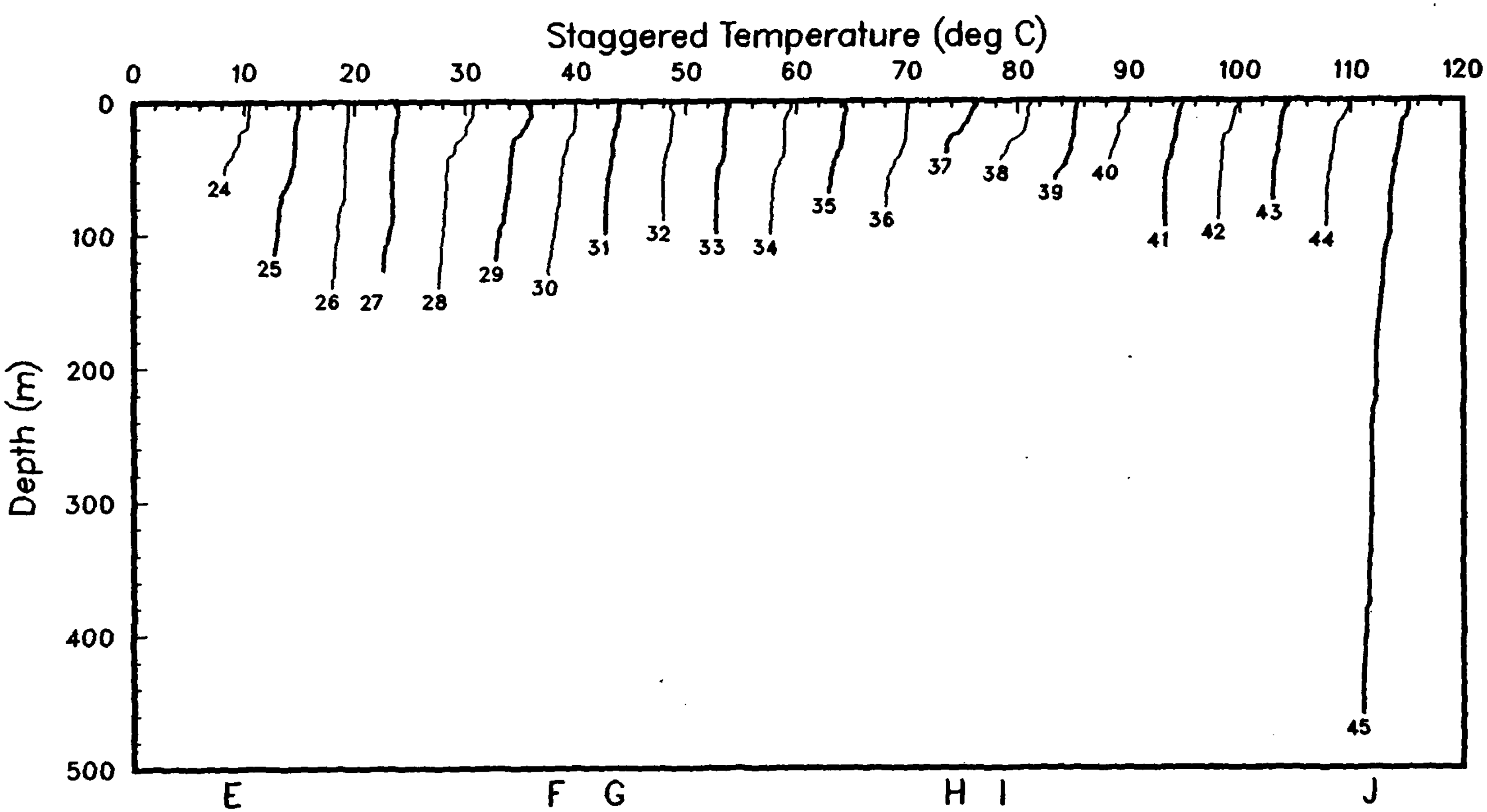

Staggered Temperature (deg C)
0 10 20 30 40 50 60 70 80 90 100 110 120
Depth (m)
0 100 200 300 400 500
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
E F G H I J

Figure 27(b)

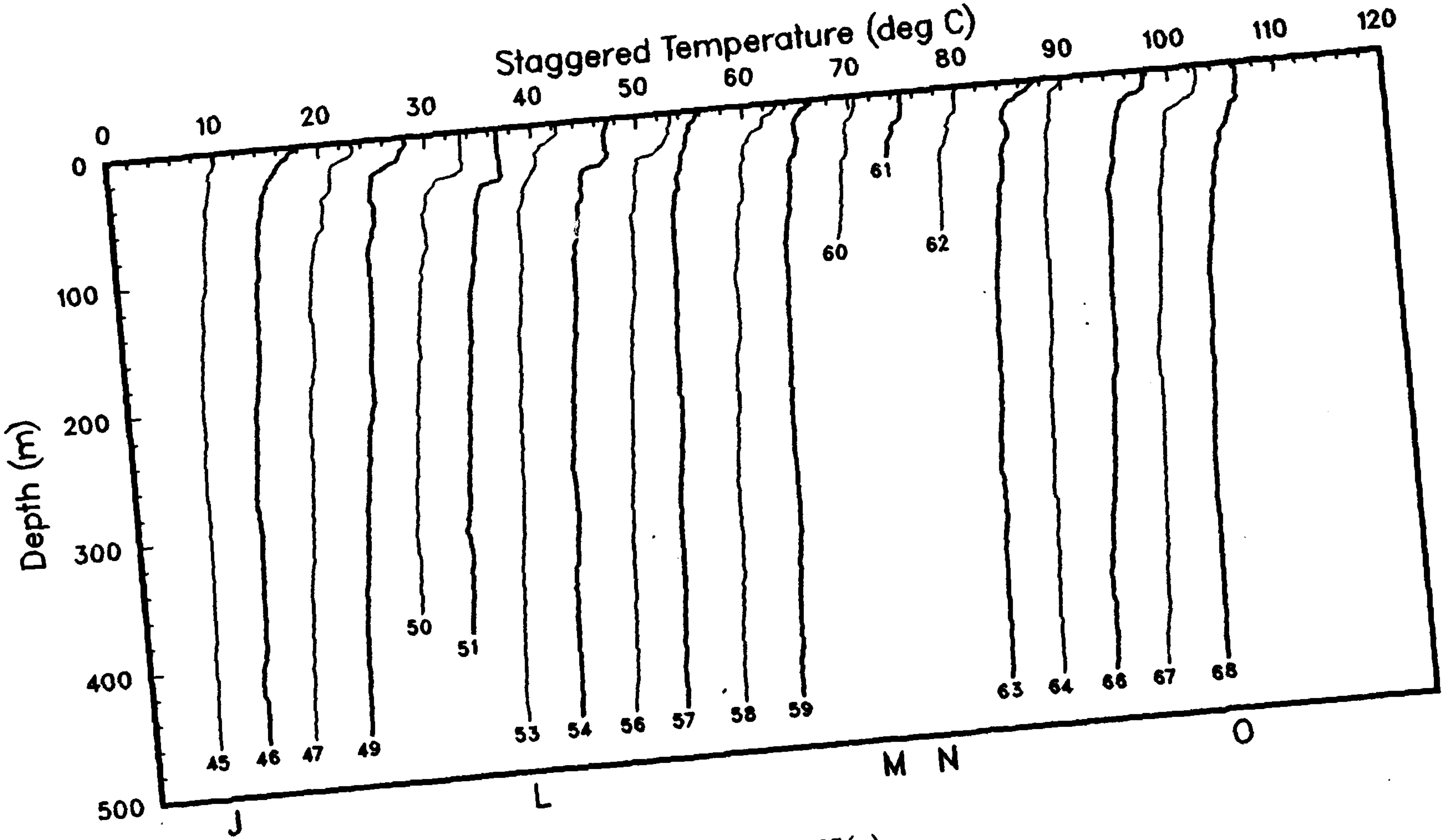
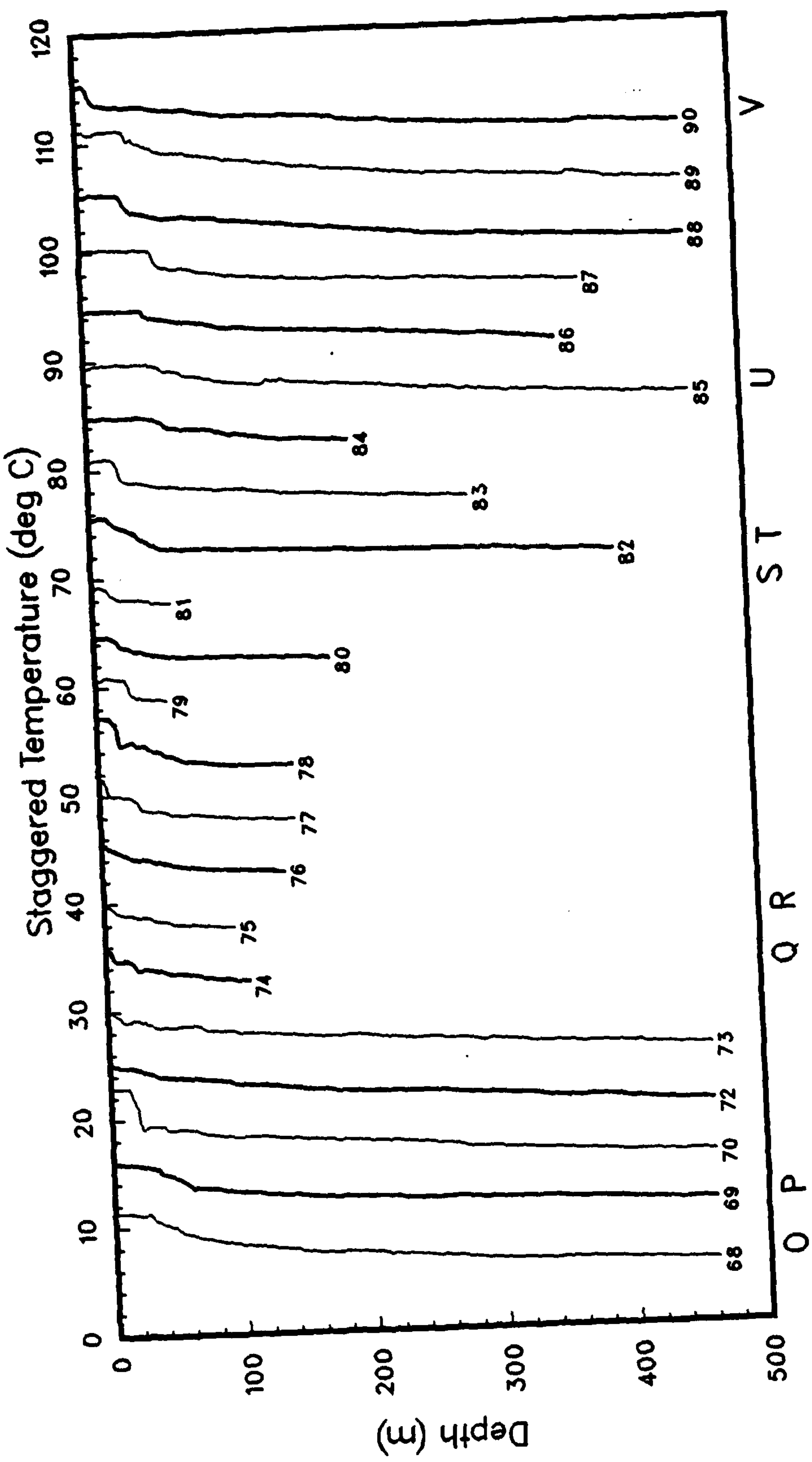

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
45
46
47
49
50
51
53
54
56
57
58
59
60
61
62
63
64
66
67
68
J
L
M
N
O

Figure 27(c)



Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
68
69
70
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
O P
Q R
S T
U
V

Figure 27(d)

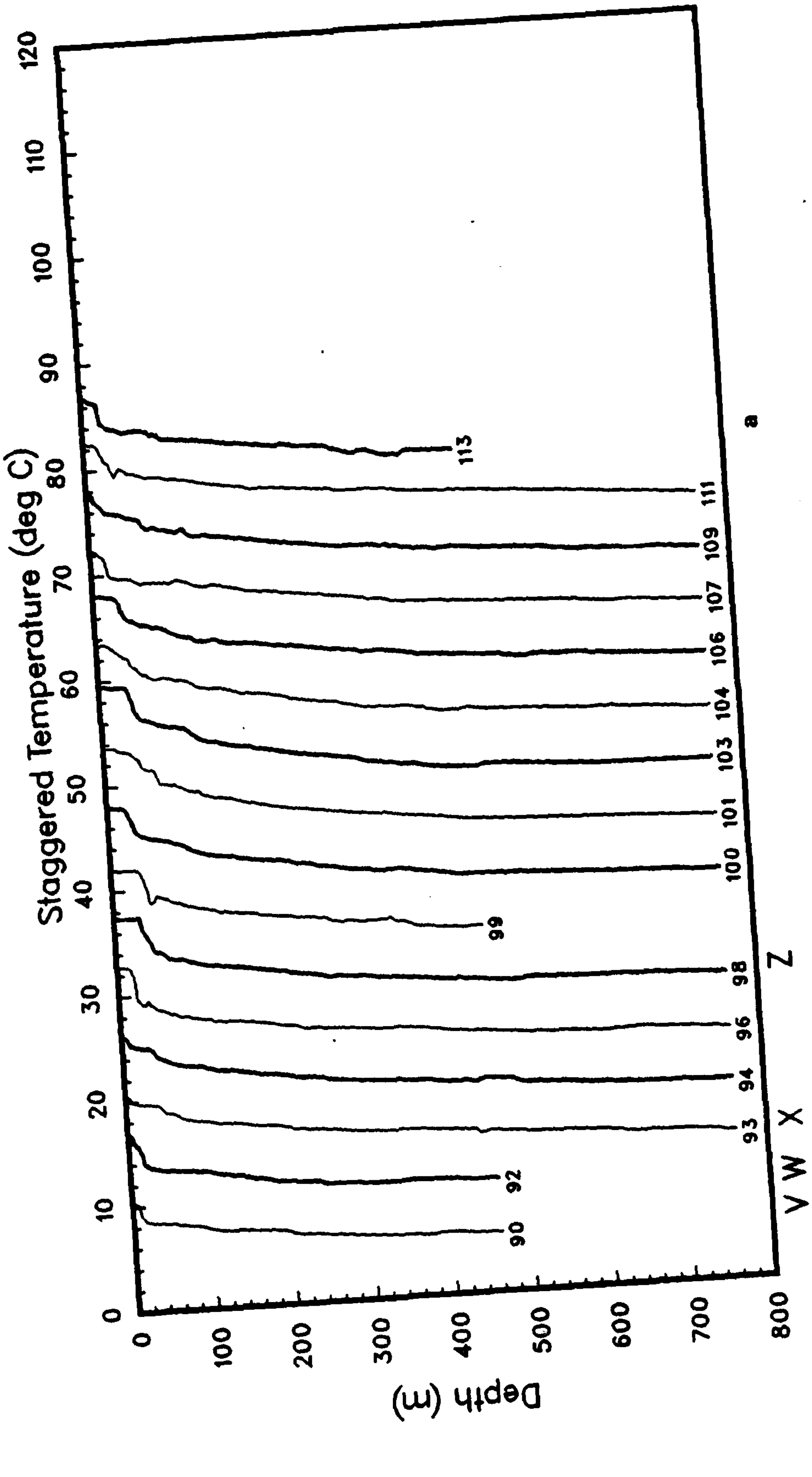

Staggered Temperature (deg C)
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
0
100
200
300
400
500
600
700
800
90
92
93
94
96
98
99
100
101
103
104
106
107
109
111
113
V W
X
Z

Figure 27(e)

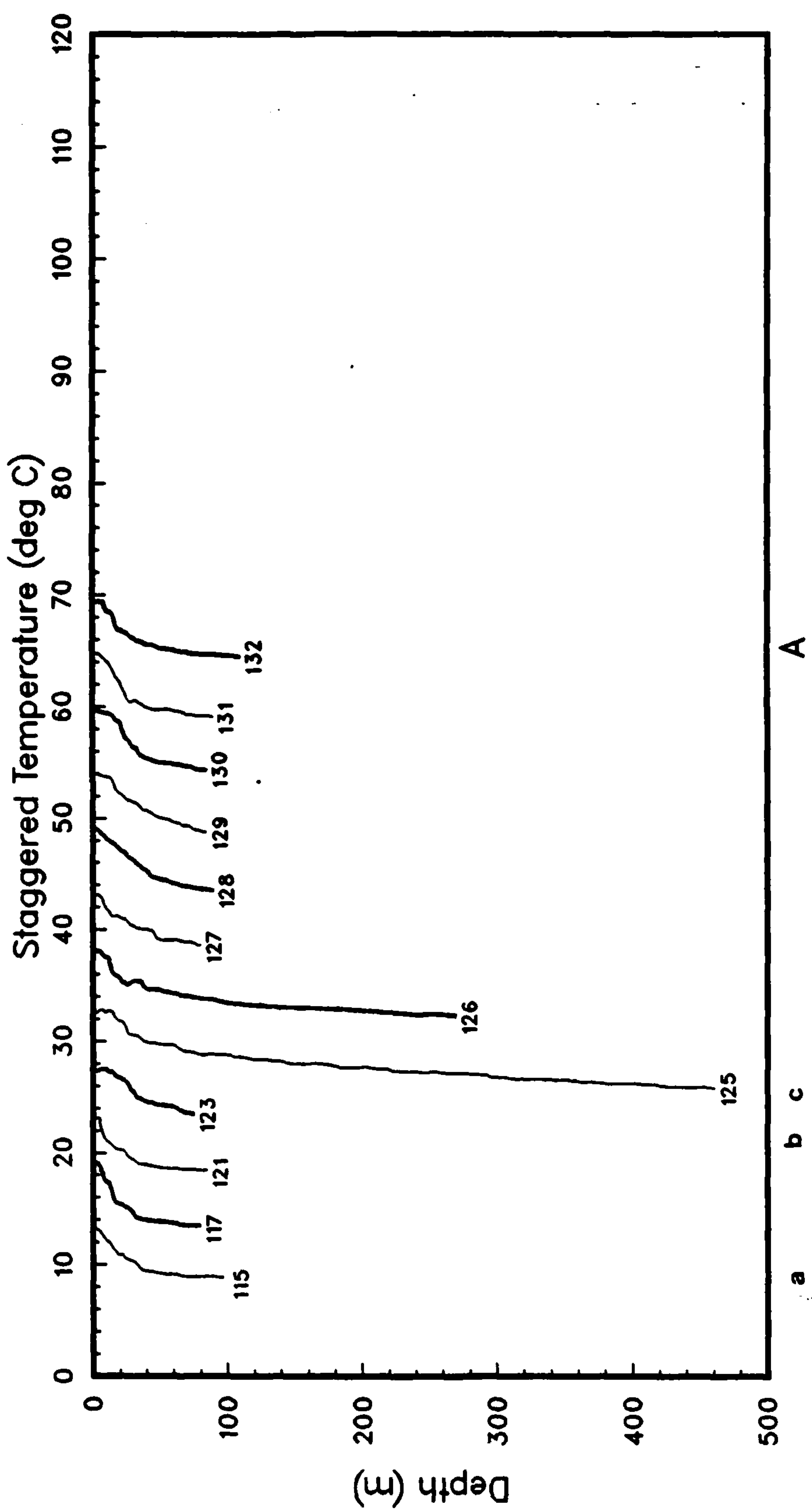

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
115
117
121
123
125
126
127
128
129
130
131
132
a
b
c
A

Figure 27(f)

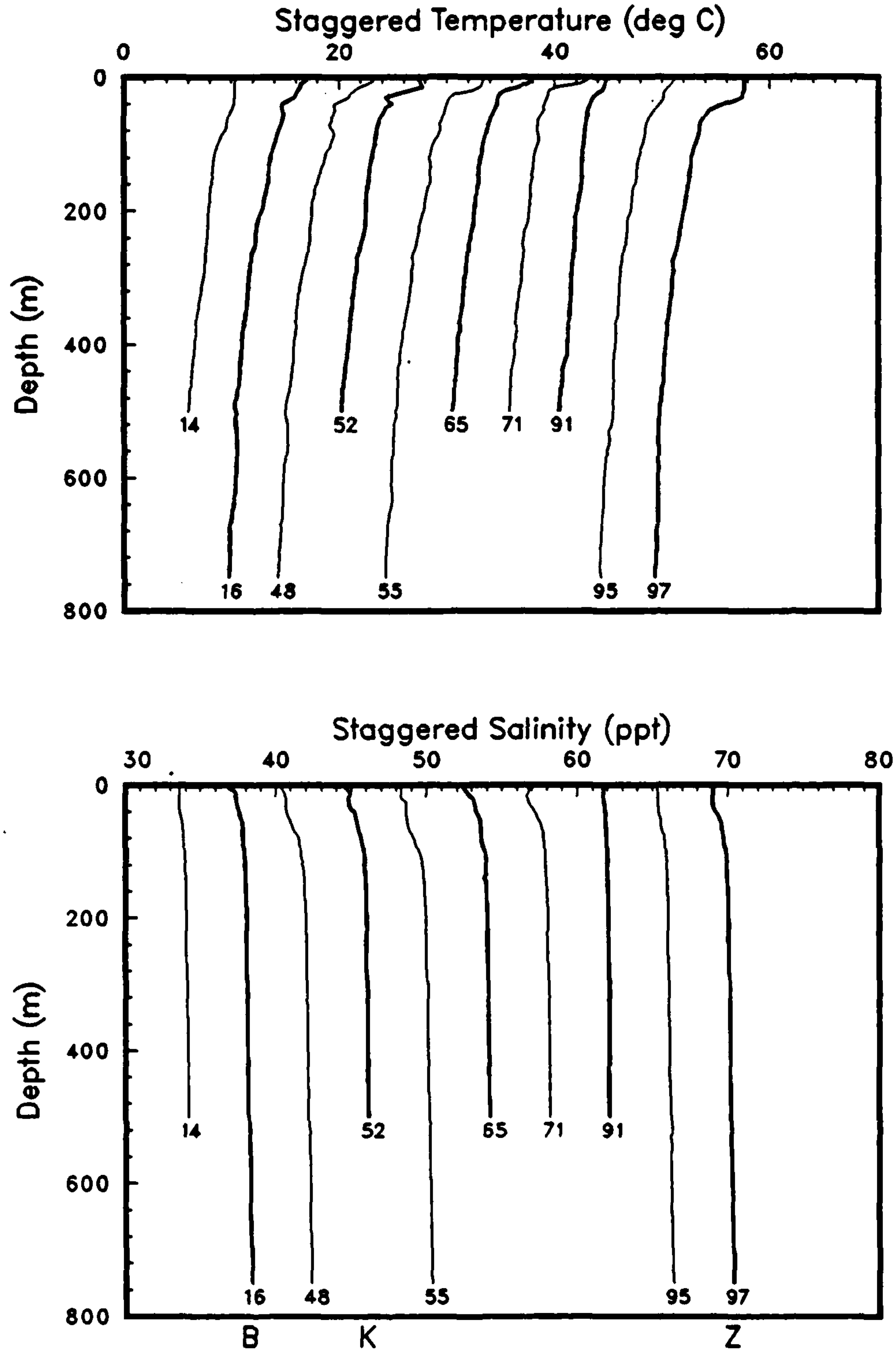


Figure 28(a): CTD temperature profiles, staggered by multiples of 5C, and salinity profiles, staggered by multiples of 4 ppt (OPTOMA16, Leg A).

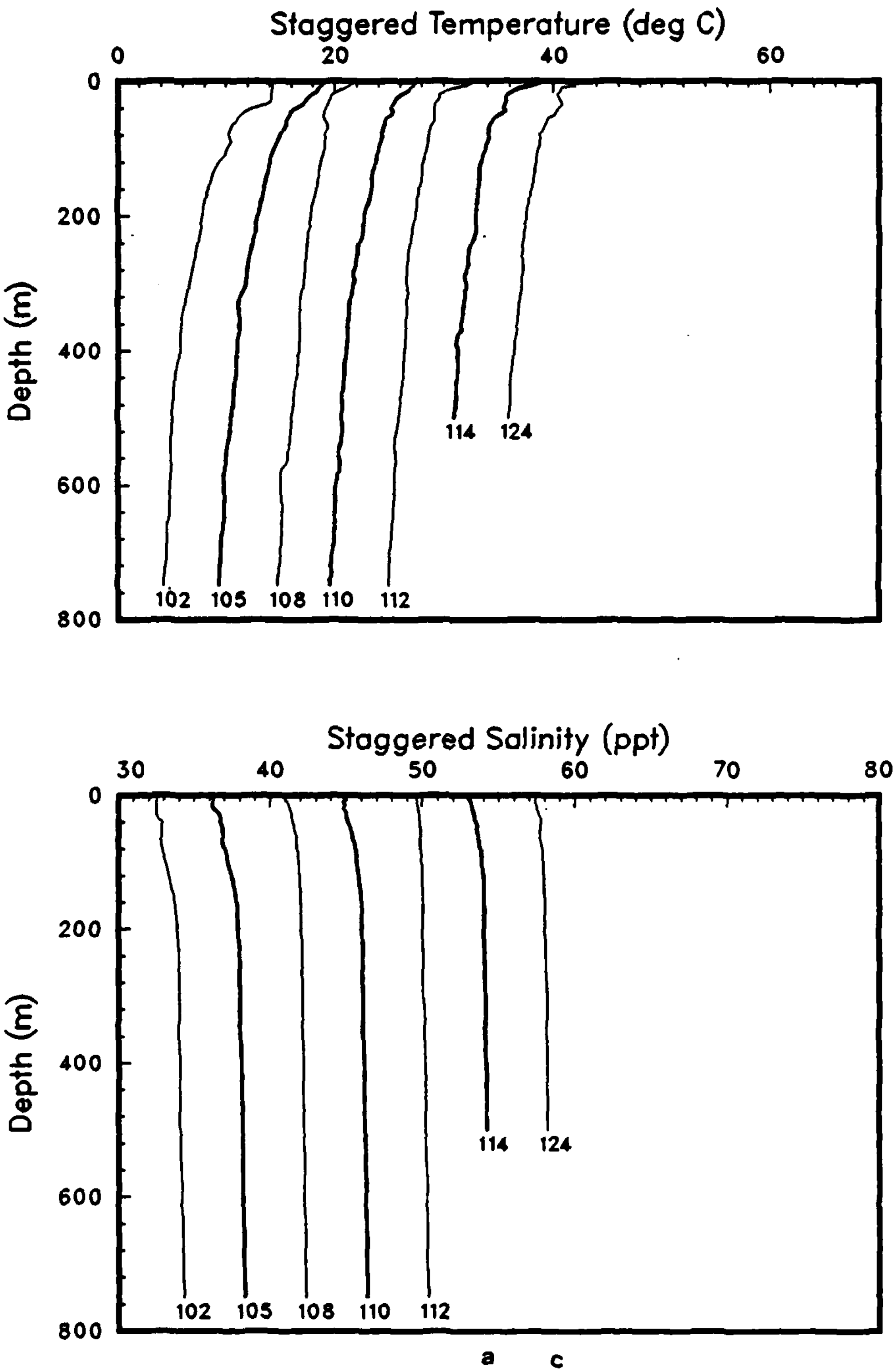

Staggered Temperature (deg C)
0
20
40
60
0
200
400
600
800
Depth (m)
102
105
108
110
112
114
124
Staggered Salinity (ppt)
30
40
50
60
70
80
0
200
400
600
800
Depth (m)
102
105
108
110
112
114
124
a
c

Figure 28(b)

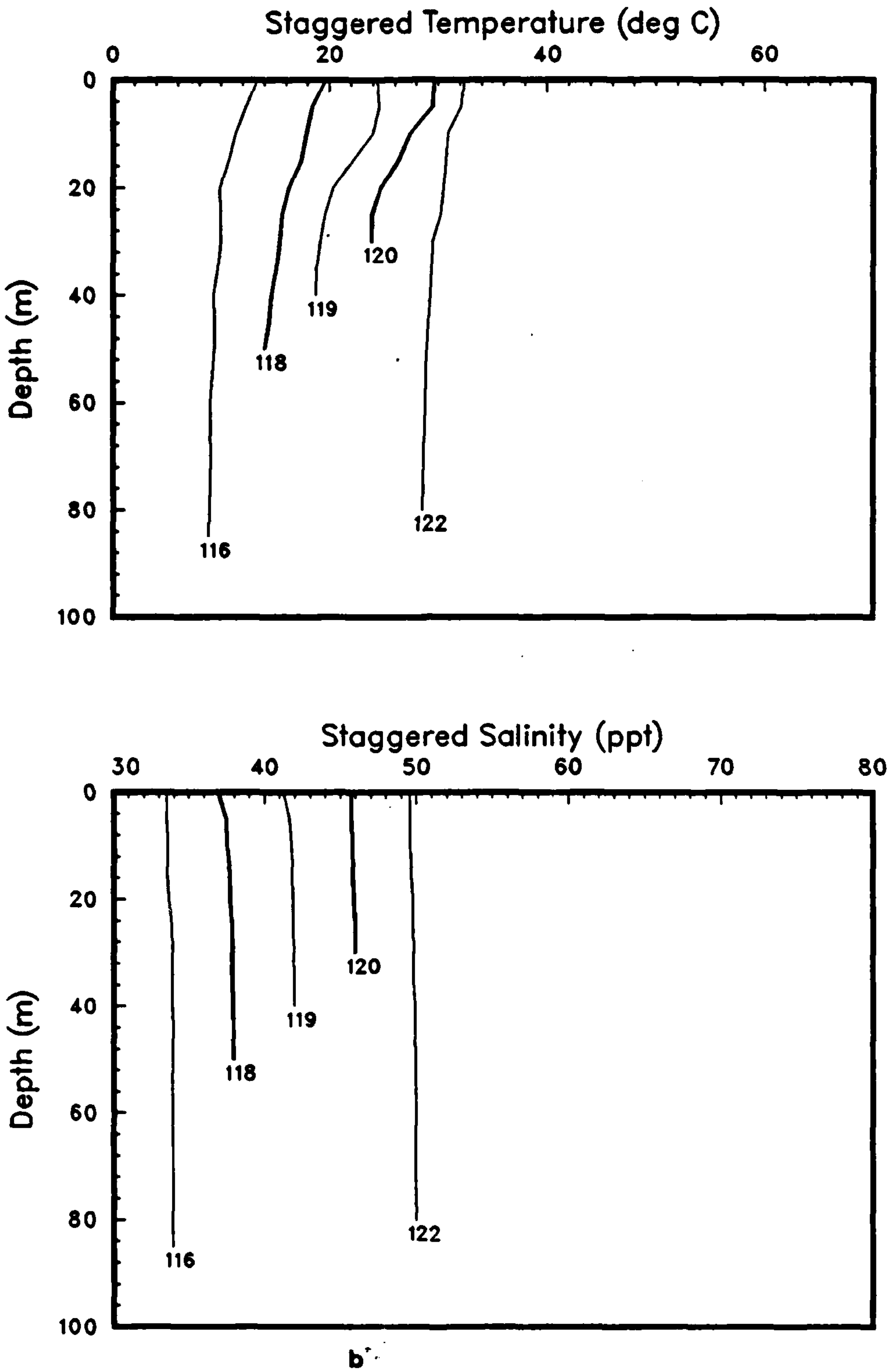

Staggered Temperature (deg C)
0
20
40
60
0
20
40
60
80
100
Depth (m)
116
118
119
120
122
Staggered Salinity (ppt)
30
40
50
60
70
80
0
20
40
60
80
100
Depth (m)
116
118
119
120
122
b

Figure 28(c)

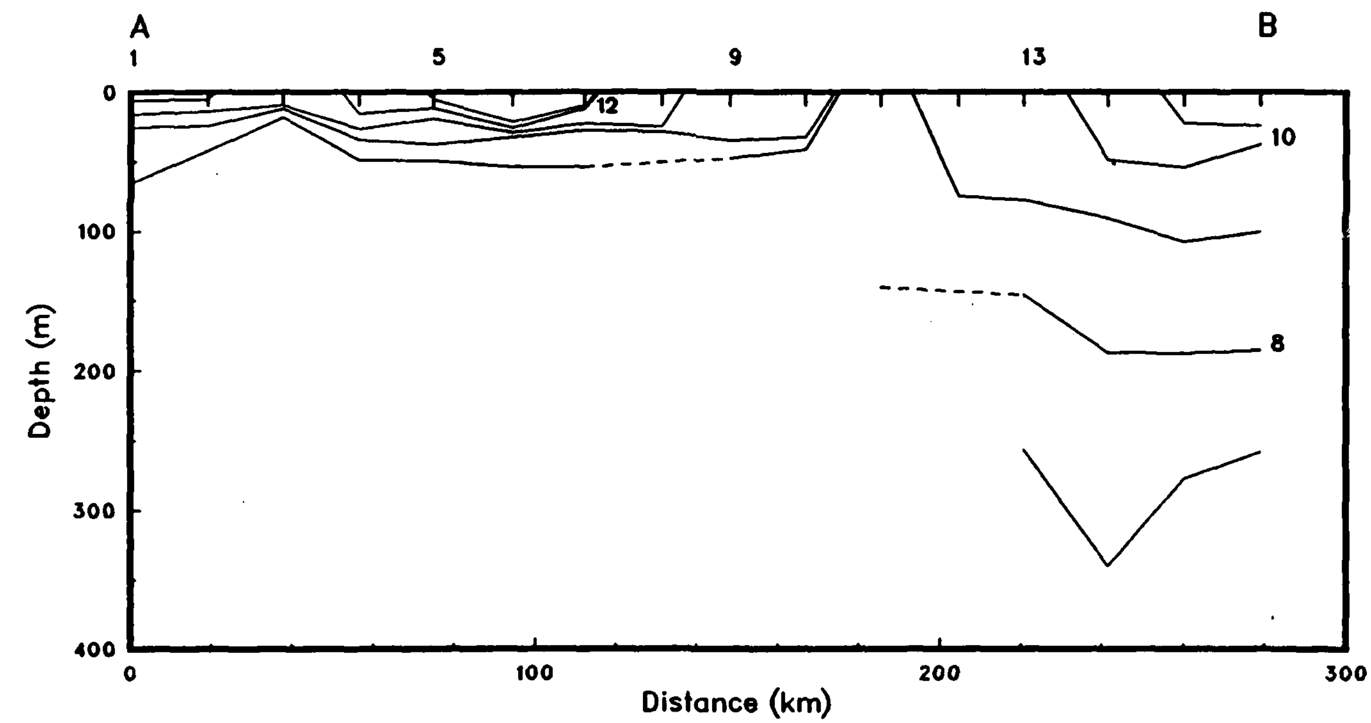


Figure 29(a): Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow (OPTOMA16, Leg A).

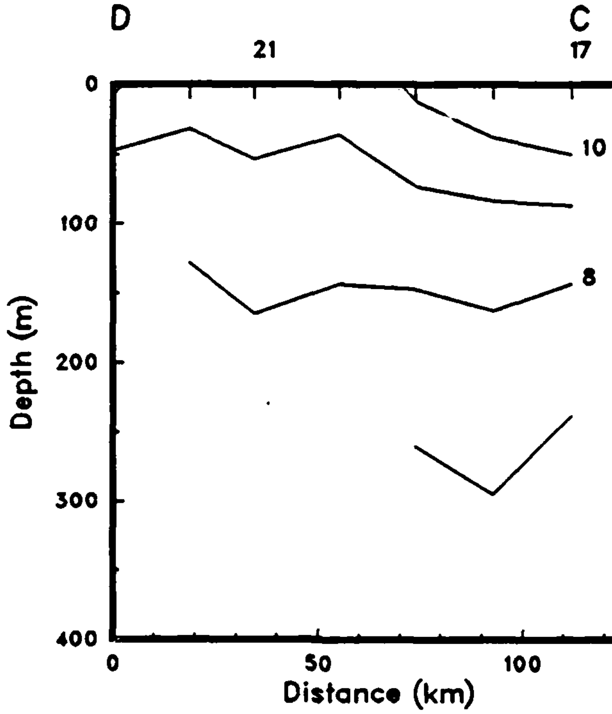


Figure 29(b)

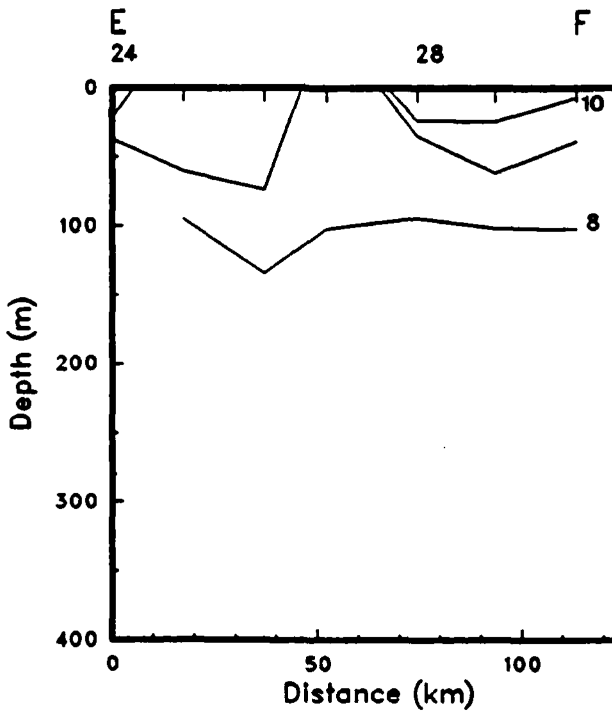


Figure 29(c)

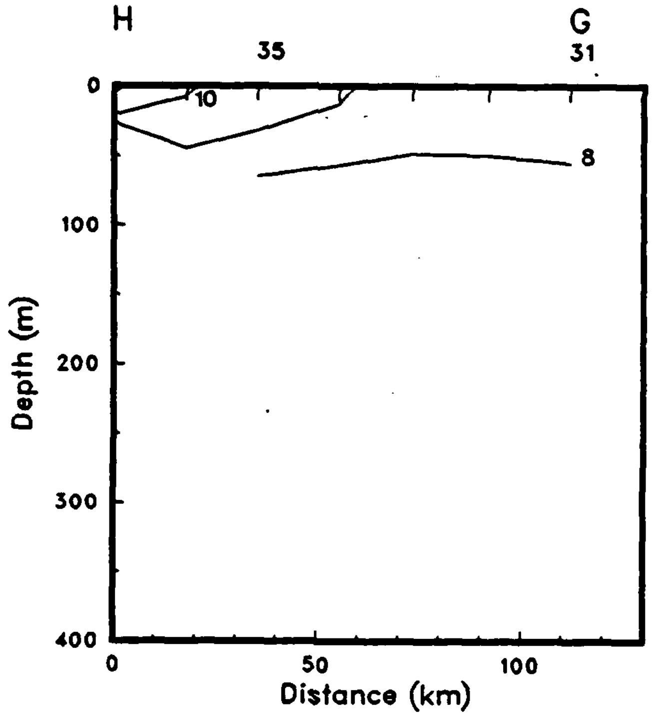


Figure 29(d)

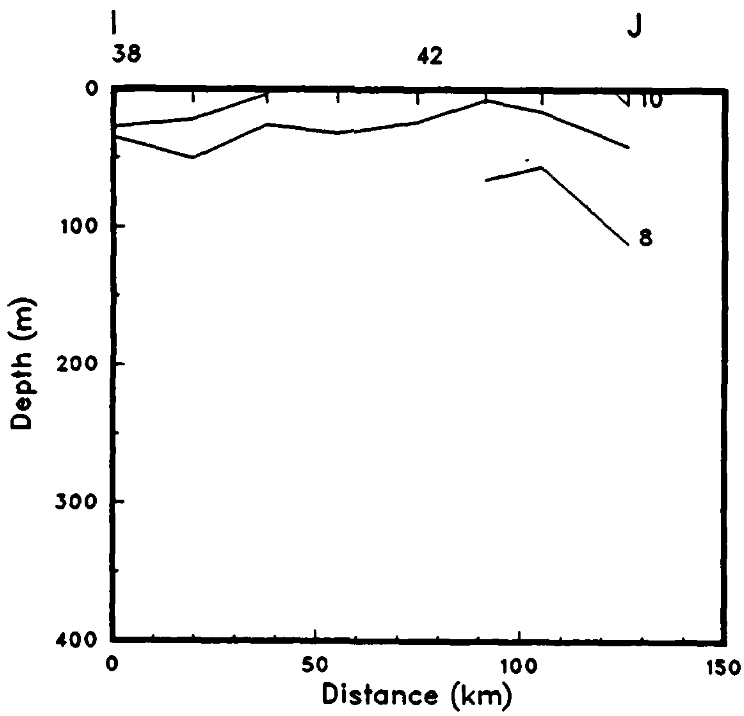


Figure 29(e)

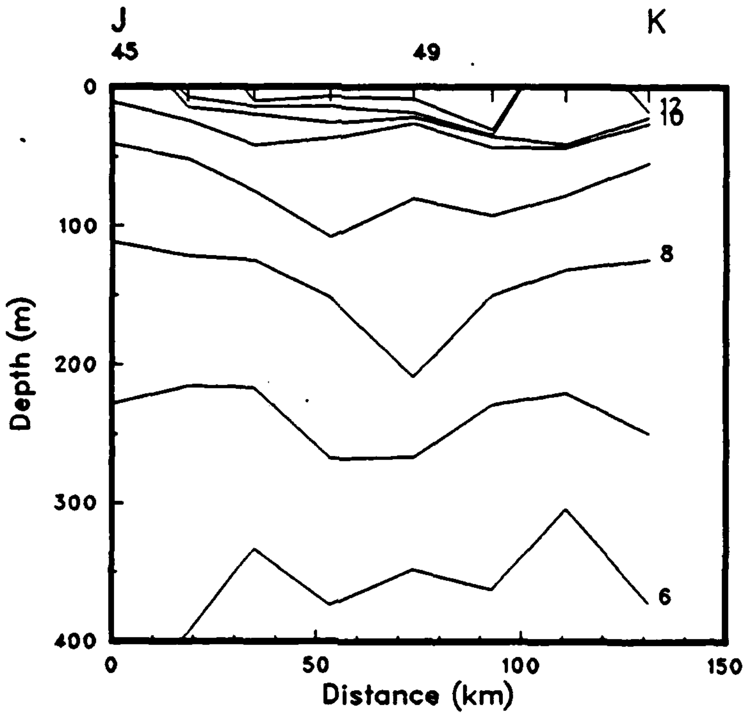


Figure 29(f)

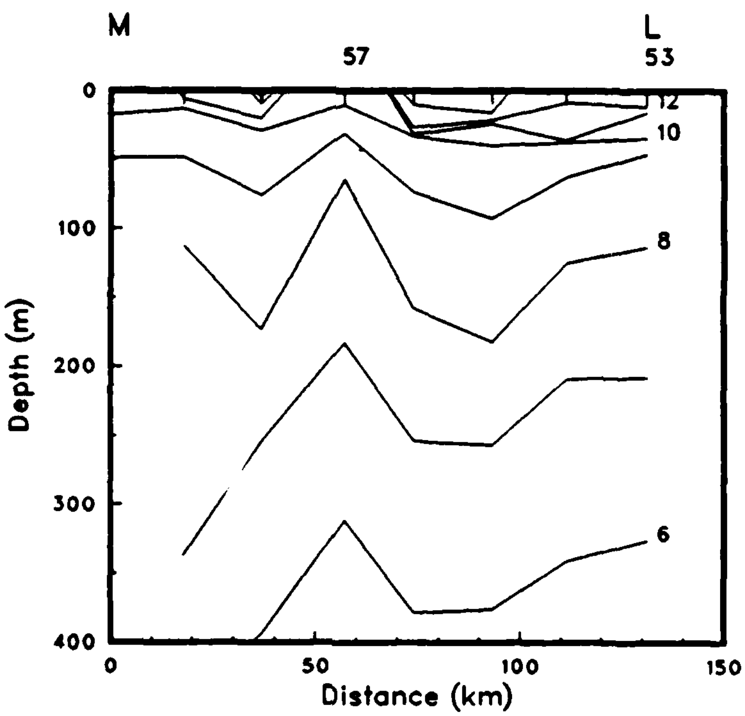


Figure 29(g)

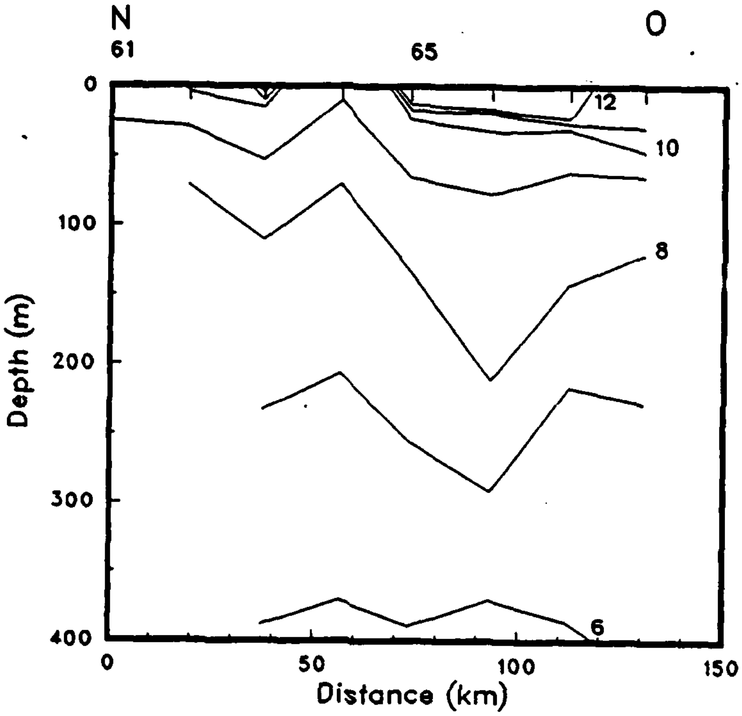


Figure 29(h)

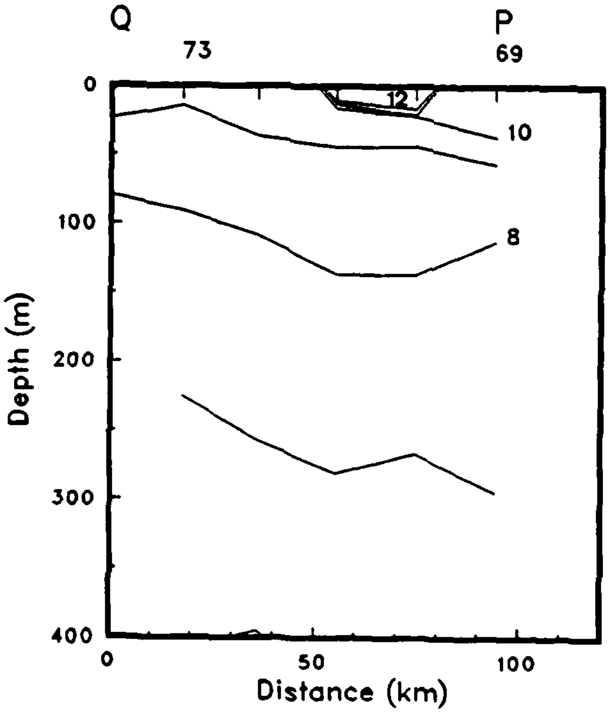


Figure 29(i)

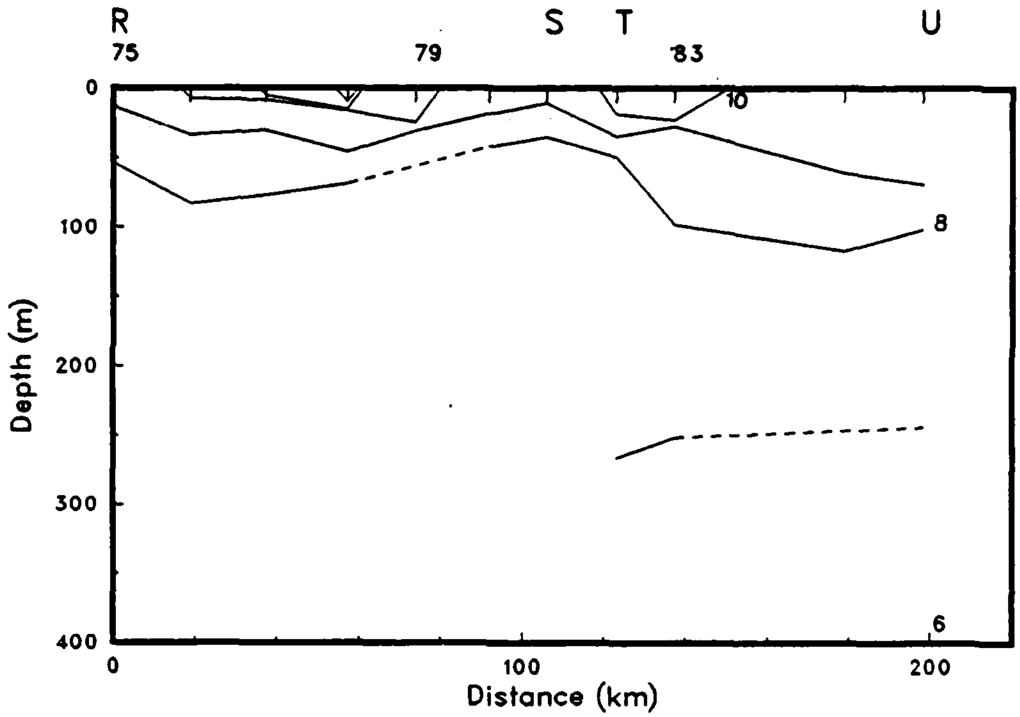


Figure 29(j)

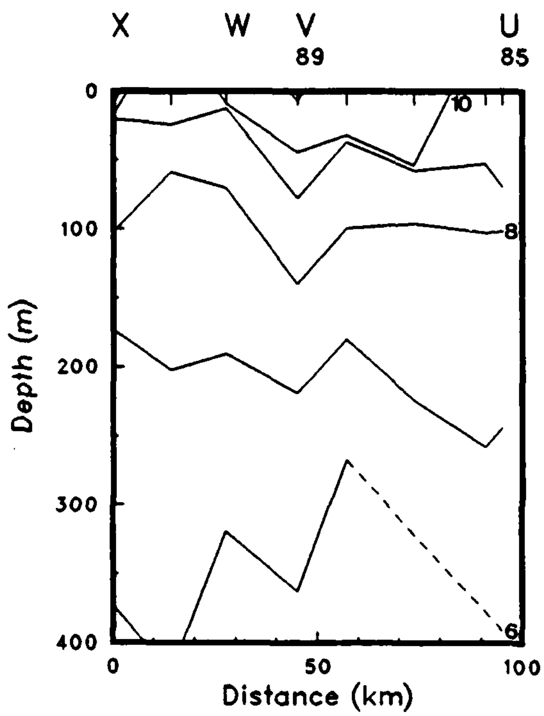


Figure 29(k)

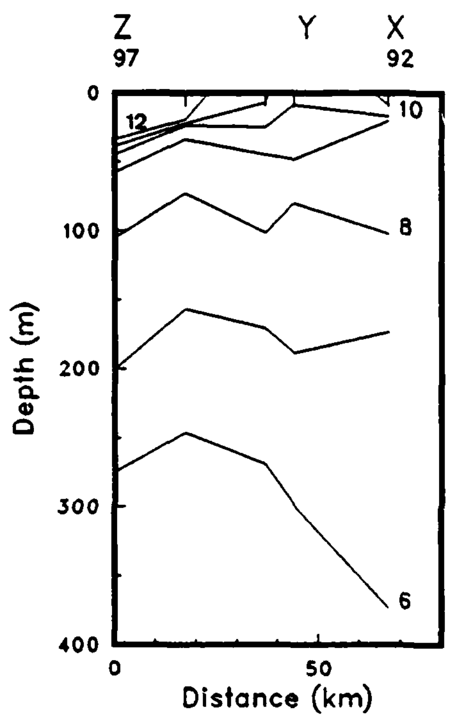


Figure 29(l)

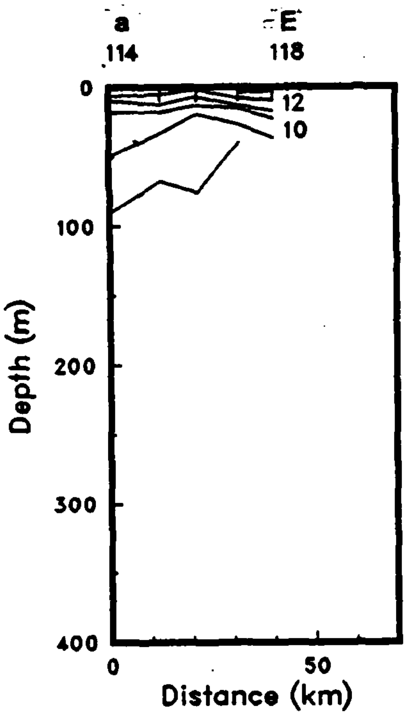


Figure 29(m)

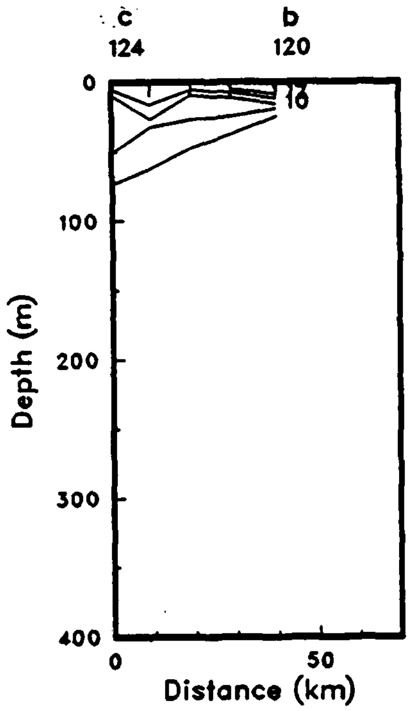


Figure 29(n)

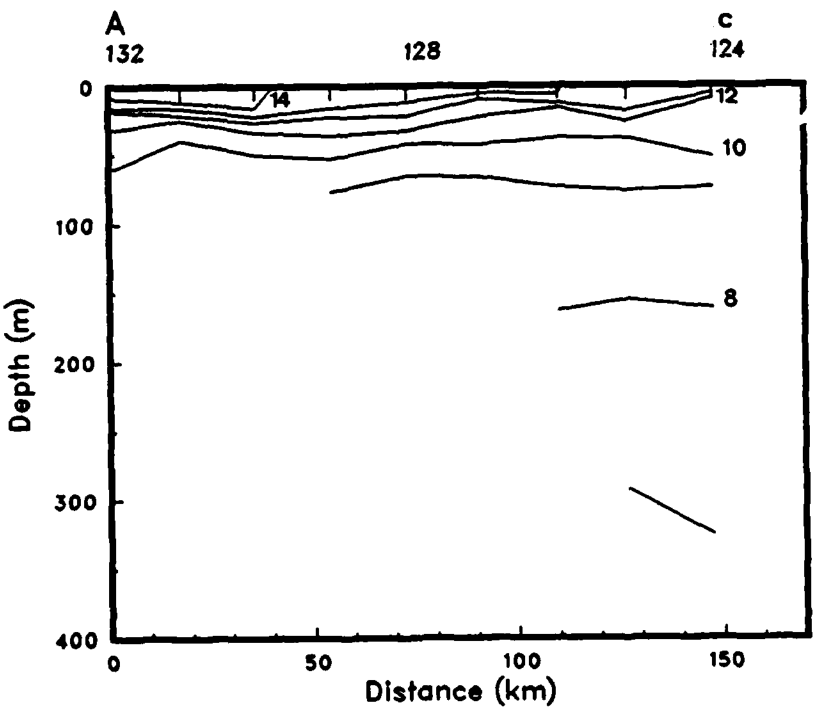


Figure 29(o)

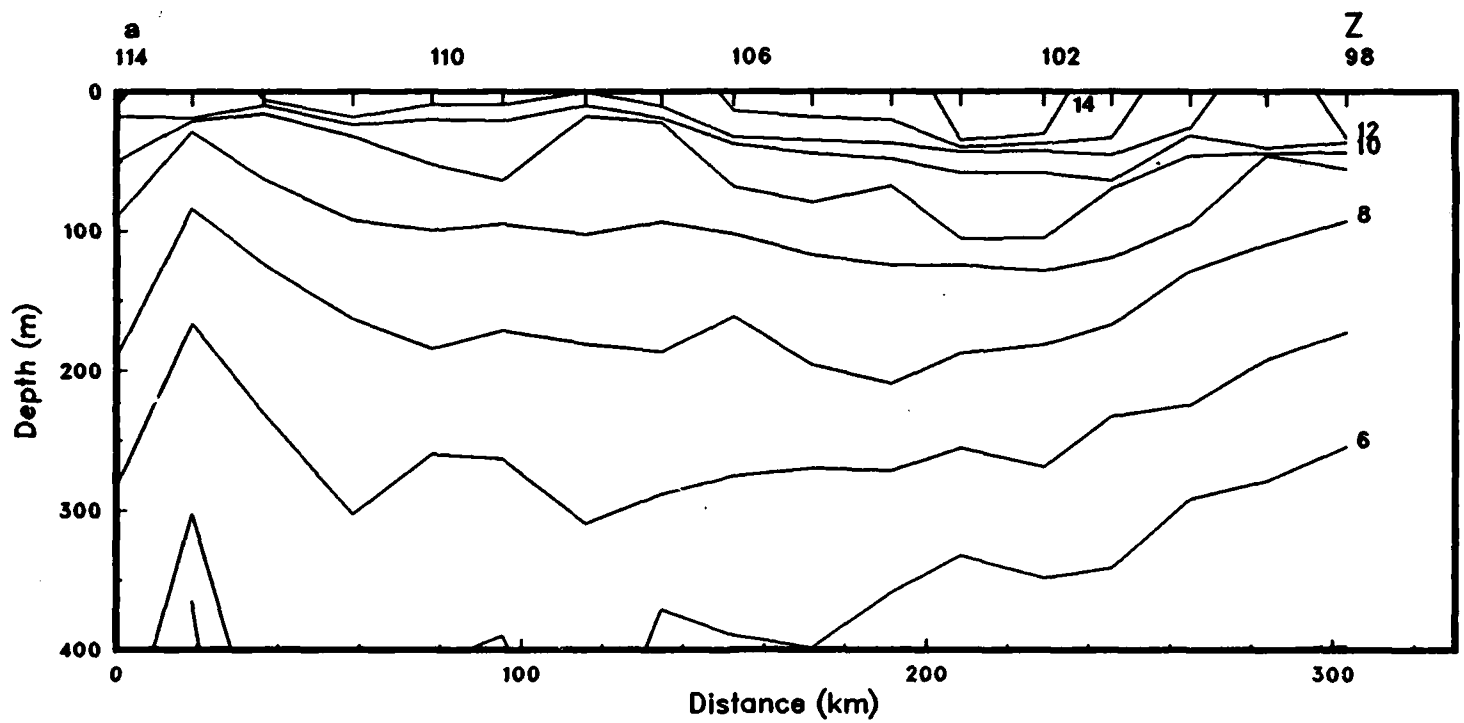
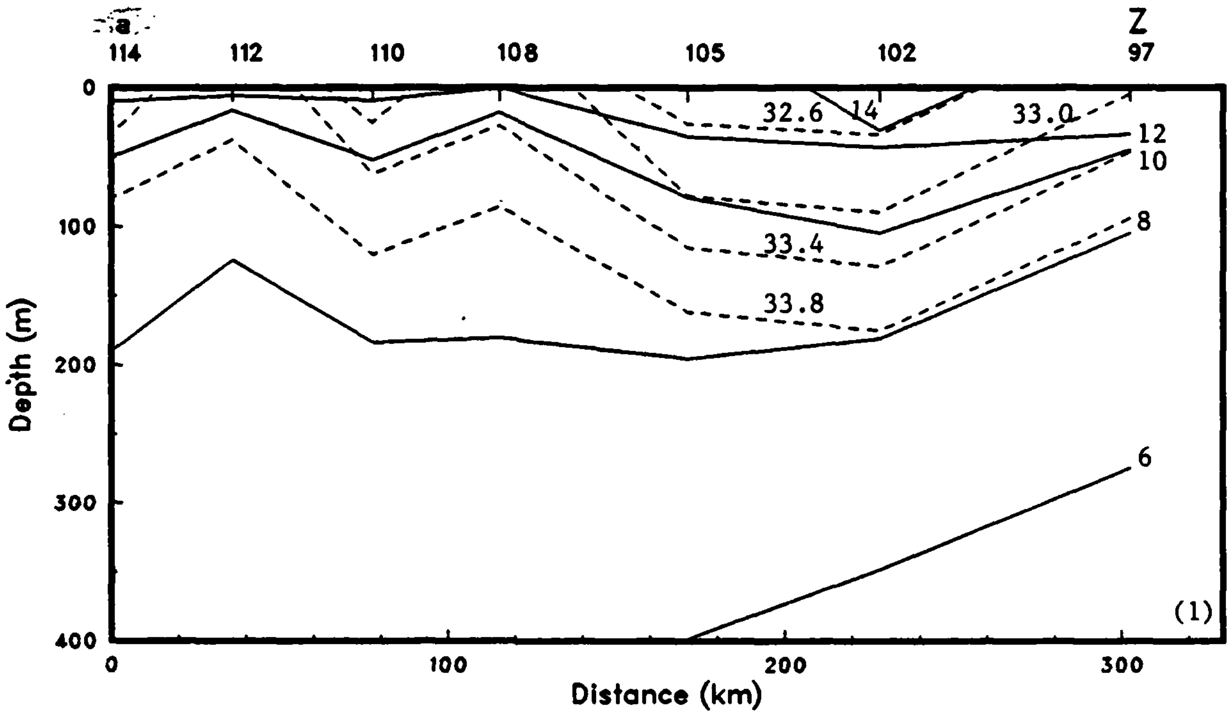

a
Z
114
110
106
102
98
14
12
10
8
6
Depth (m)
0
100
200
300
400
Distance (km)
0
100
200
300

Figure 29(p)



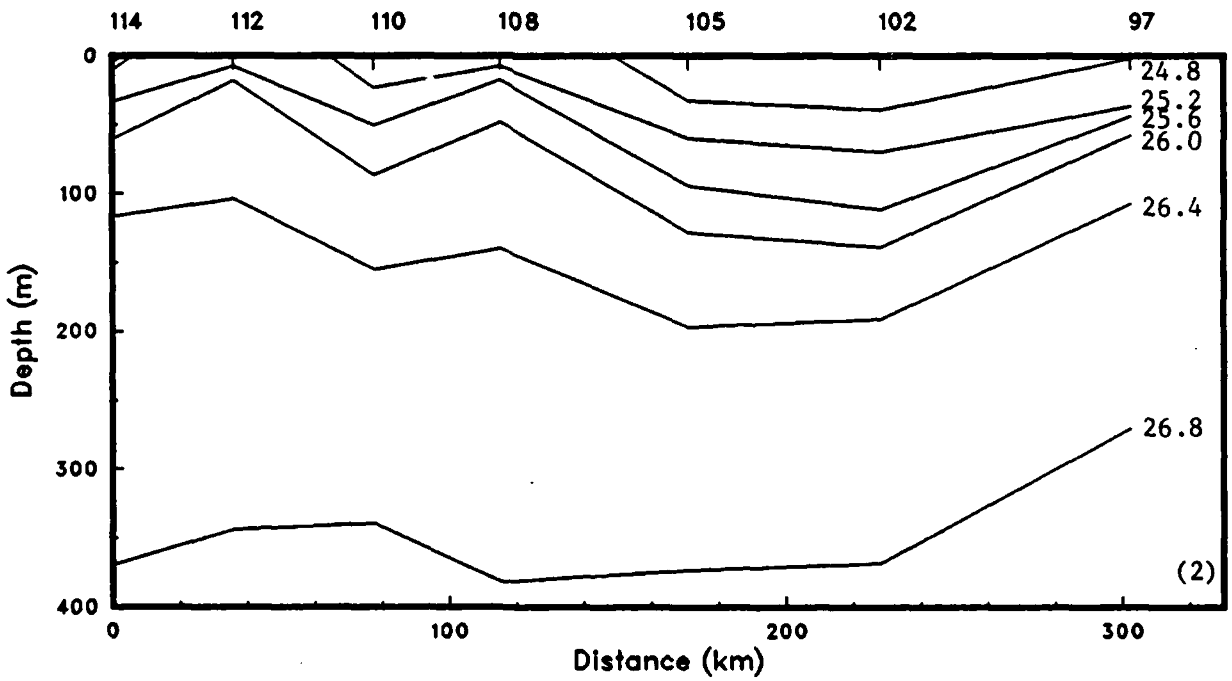


Figure 30(a): Isopleths of (1) temperature and salinity and (2) sigma-t from the CTD's (OPTOMA16, Leg A).

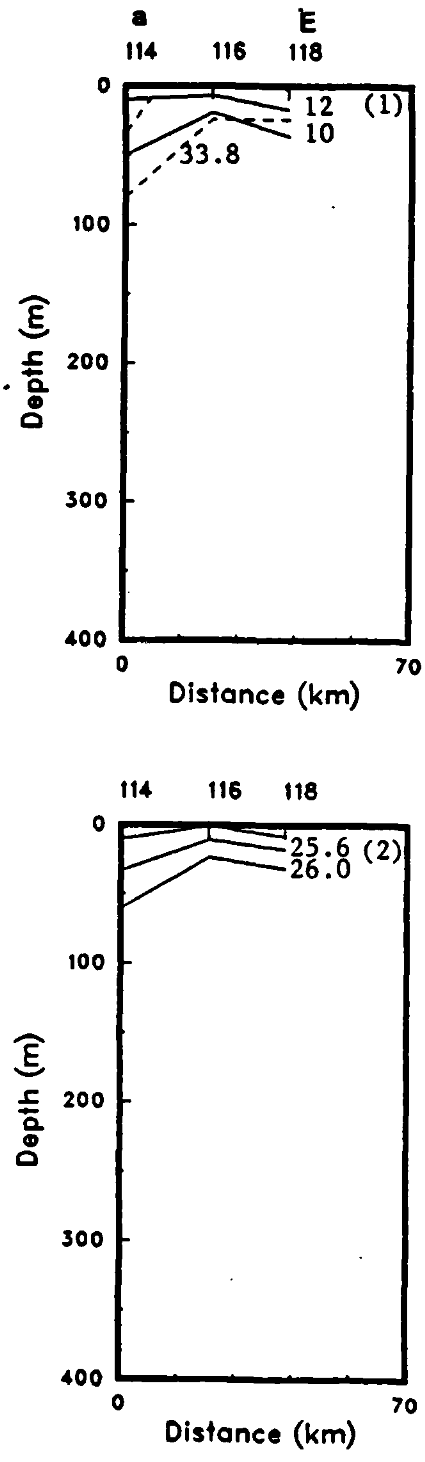


Figure 30(b)

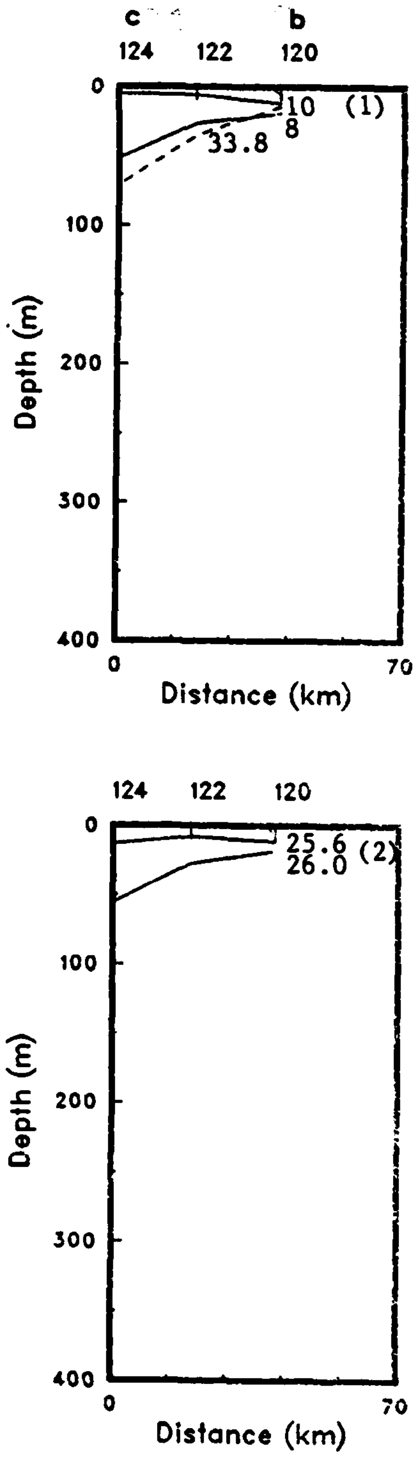


Figure 30(c)

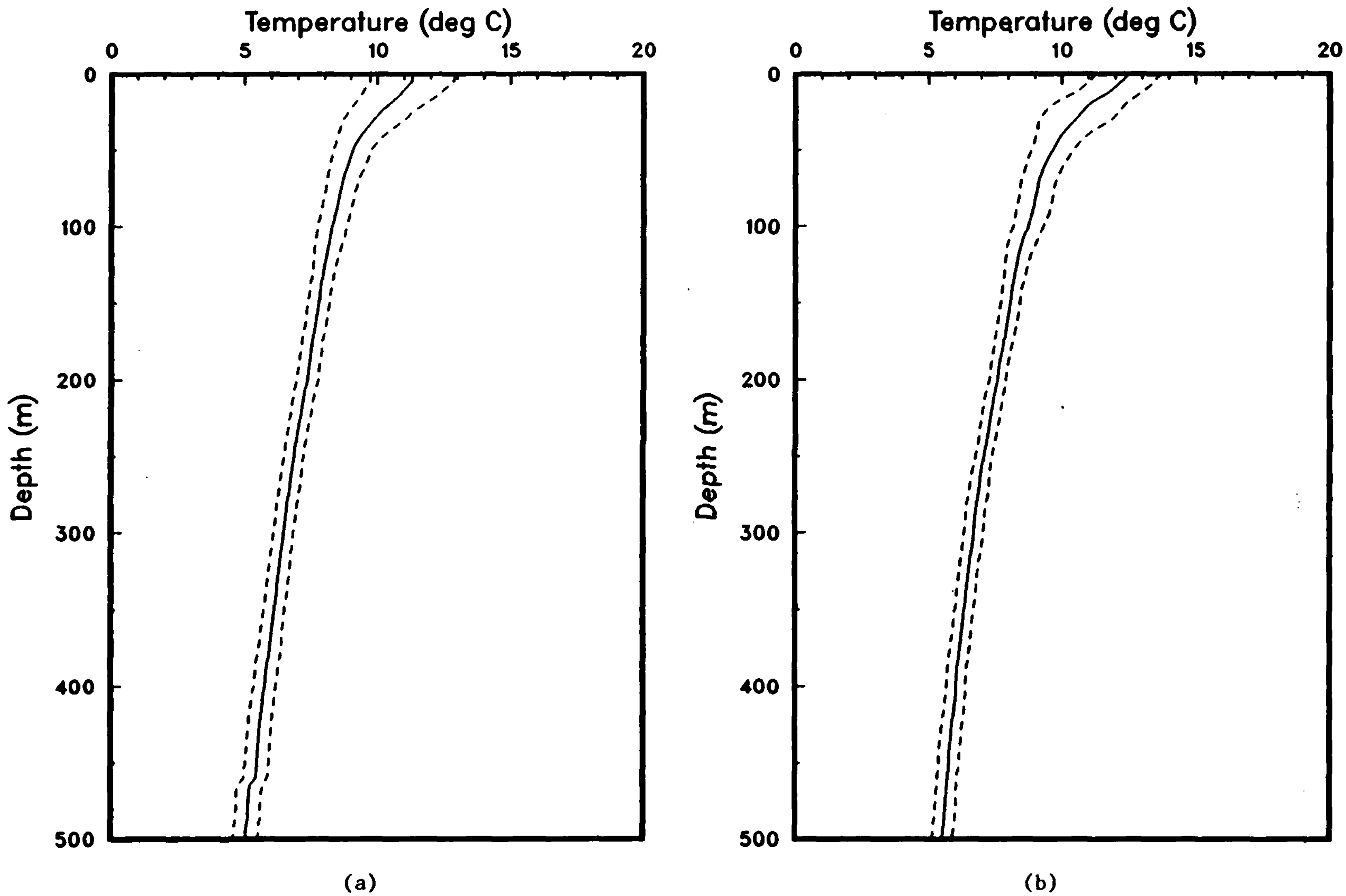


Figure 31: Mean temperature profiles from (a) XBT's and (b) CTD's, with + and - the standard deviation (OPTOMA16, Leg A).

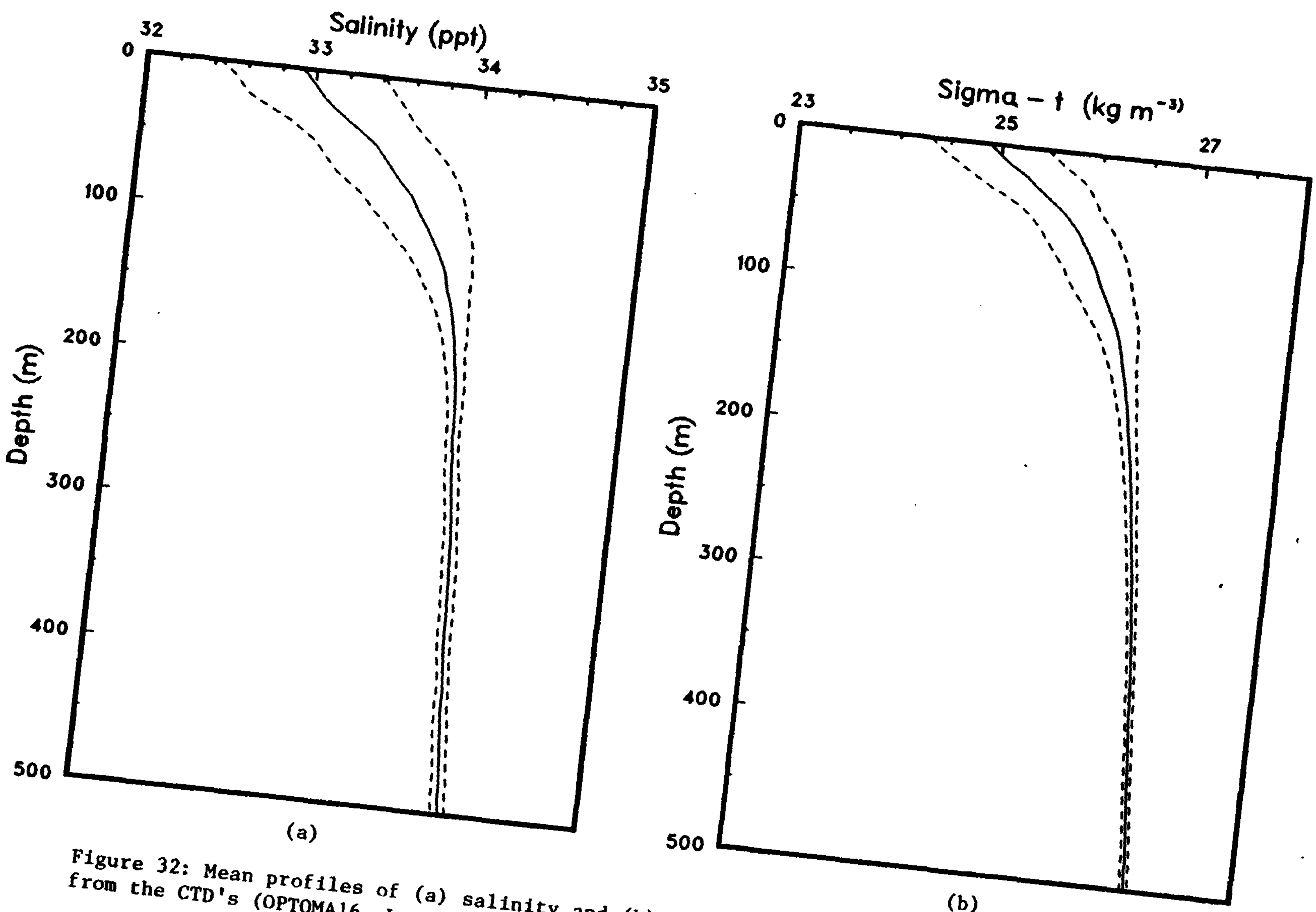


Figure 32: Mean profiles of (a) salinity and (b) sigma-t, with + and - the standard deviations, from the CTD's (OPTOMA16, Leg A).

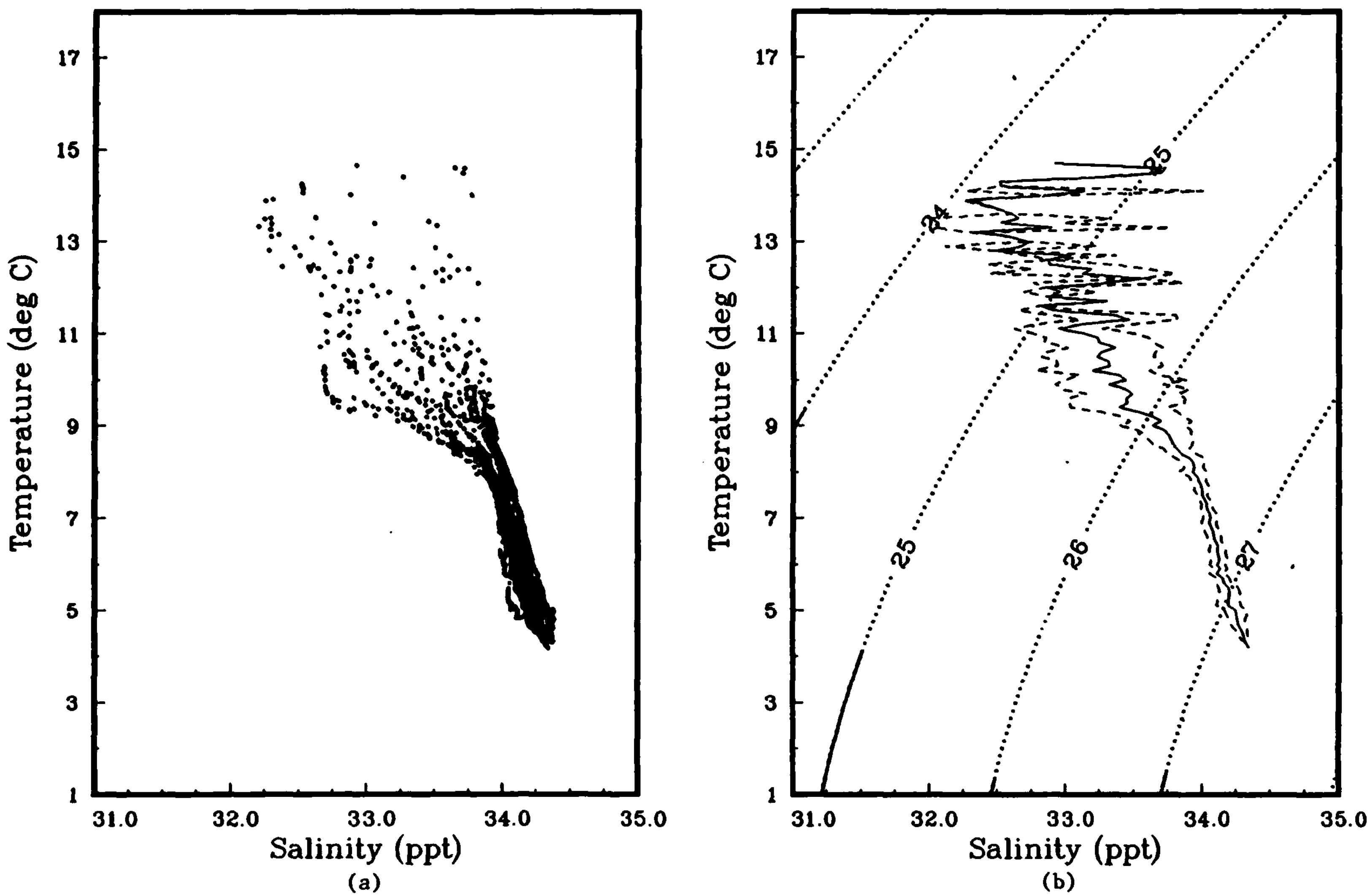


Figure 33: (a) T-S pairs and (b) mean T-S relation, with + and - the standard deviation, from the CTD's. Selected sigma-t contours are also shown (OPTOMA16, Leg A).

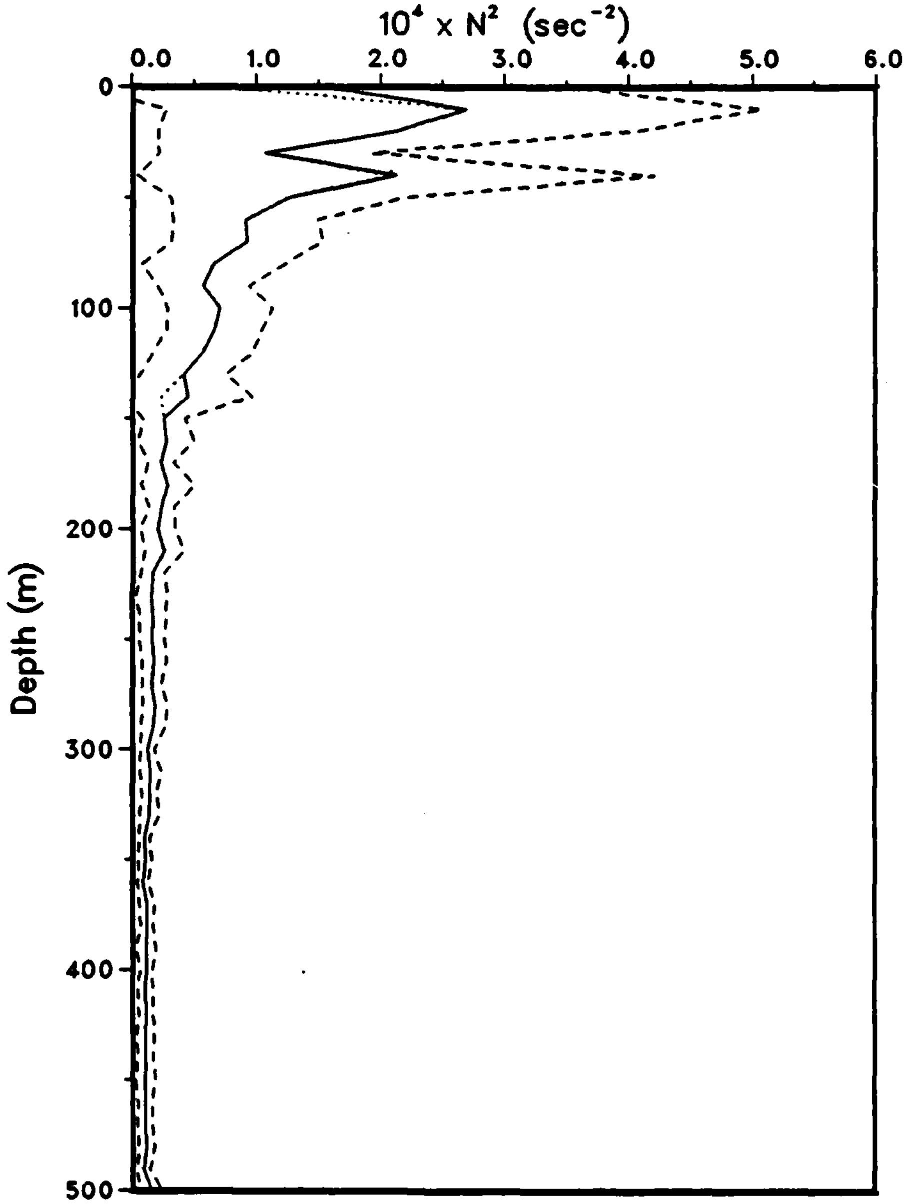


Figure 34: Mean N^2 profile(——), with + and - the standard deviation (---). The N^2 profile from $\overline{T(z)}$ and $\overline{S(z)}$ is also shown (...) (OPTOMA16, Leg A).

ACKNOWLEDGEMENTS

This research was sponsored by the ONR Physical Oceanography Program. The success of the fieldwork was strongly dependent on the competent, willing support of the crew of the NOAA Ship McARTHUR and R/V ACANIA. The National Ocean Service, NOAA is thanked for making the NOAA ship McARTHUR available for cooperative PMEL and NPS ocean circulation and mesoscale prediction studies of the Pacific Coast EEZ. Members of the scientific cruise party were:

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